CERAMIC ABSTRACTS and THE BULLETIN

AMERICAN CERAMIC SOCIETY

JUNE 15, 1942

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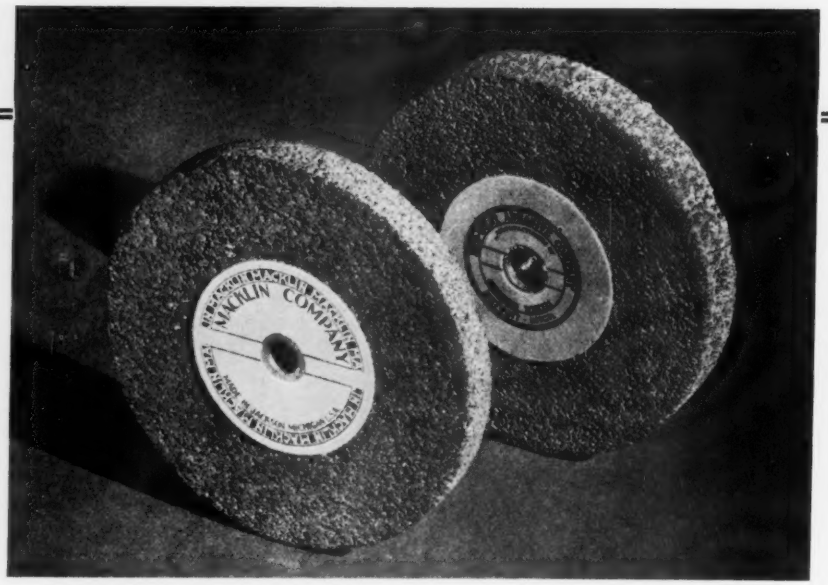

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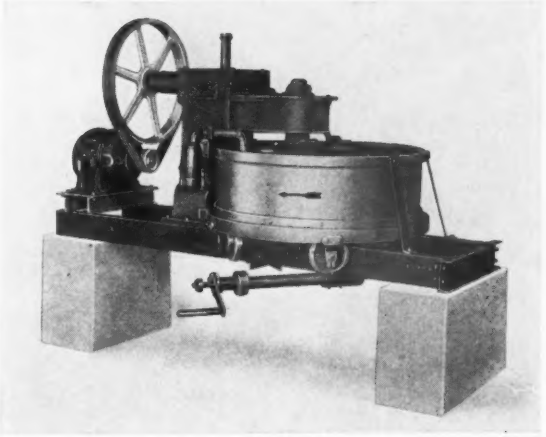

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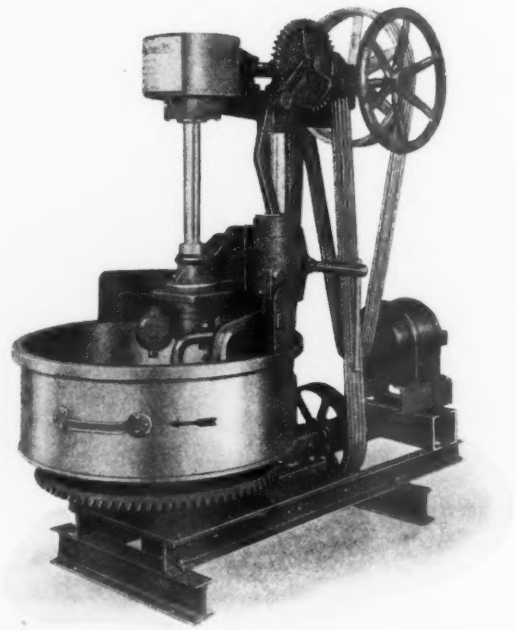

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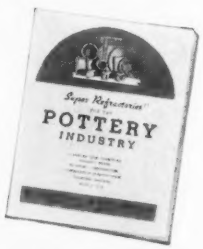

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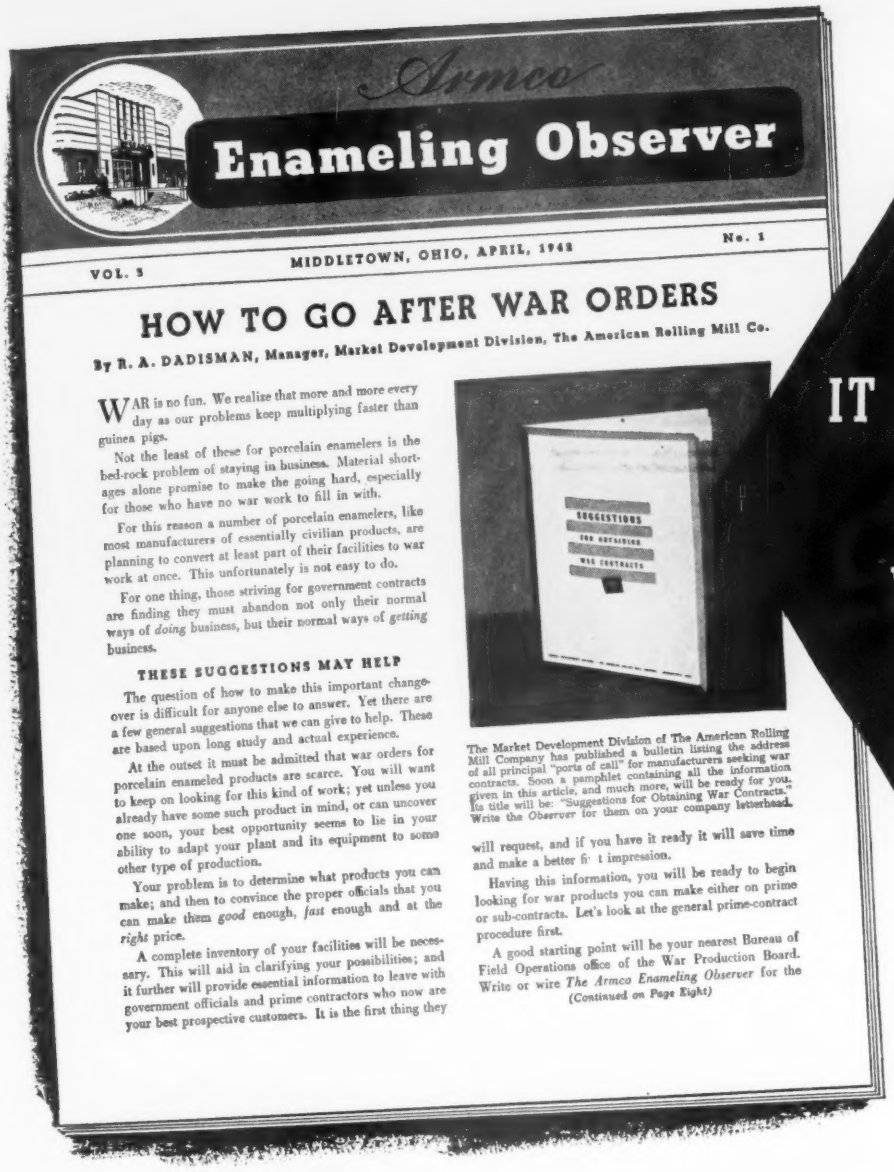

Armco

Enameling Observer

VOL. 5 — MIDDLETOWN, OHIO, APRIL, 1942 — No. 1

HOW TO GO AFTER WAR ORDERS

By R. A. DADISMAN, Manager, Market Development Division, The American Rolling Mill Co.

WAR is no fun. We realize that more and more every day as our problems keep multiplying faster than guinea pigs.

Not the least of these for porcelain enamelers is the bed-rock problem of staying in business. Material shortages alone promise to make the going hard, especially for those who have no war work to fill in with.

For this reason a number of porcelain enamelers, like most manufacturers of essentially civilian products, are planning to convert at least part of their facilities to war work at once. This unfortunately is not easy to do.

For one thing, those striving for government contracts are finding they must abandon not only their normal ways of *doing* business, but their normal ways of *getting* business.

THESE SUGGESTIONS MAY HELP

The question of how to make this important change-over is difficult for anyone else to answer. Yet there are a few general suggestions that we can give to help. These are based upon long study and actual experience.

At the outset it must be admitted that war orders for porcelain enameled products are scarce. You will want to keep on looking for this kind of work; yet unless you already have some such product in mind, or can uncover one soon, your best opportunity seems to lie in your ability to adapt your plant and its equipment to some other type of production.

Your problem is to determine what products you can make; and then to convince the proper officials that you can make them *good* enough, *fast* enough and at the *right* price.

A complete inventory of your facilities will be necessary. This will aid in clarifying your possibilities; and it further will provide essential information to leave with government officials and prime contractors who now are your best prospective customers. It is the first thing they will request, and if you have it ready it will save time and make a better fi t impression.

The Market Development Division of The American Rolling Mill Company has published a bulletin listing the address of all principal "ports of call" for manufacturers seeking war contracts. Soon a pamphlet containing all the information given in this article, and much more, will be ready for you. Its title will be: "Suggestions for Obtaining War Contracts." Write the *Observer* for them on your company letterhead.

Having this information, you will be ready to begin looking for war products you can make either on prime or sub-contracts. Let's look at the general prime-contract procedure first.

A good starting point will be your nearest Bureau of Field Operations office of the War Production Board. Write or wire *The Armco Enameling Observer* for the

(Continued on Page Eight)

IT MAY LEAD YOU TO A WAR ORDER!

GET YOUR FREE COPY

SUMMARY OF ARTICLES

How to Go after War Orders: Many suggestions based on actual experience tell how to adapt your plant to war products: Who to see about getting orders. . . . What your best arguments are. . . . Hints on getting prime and sub-contracts, and more.

How One Enameler Got a Contract: The story of how a Kentucky enameler obtained a fine order for zinc-coated metal powder cans. His experiences may help you.

What's Cookin'? News items telling how other enamelers are meeting the situation.

Conversion — the New Order of the Day: A helpful *Observer* editorial.

How to Work with Mixed Stock in These Troublesome Times: It tells how to get the most out of non-uniform stock. Gives suggestions for correcting sagging, cleaning odd lots and other helpful production methods.

READ OVER the summary of the articles in this special issue of *The Armco Enameling Observer* and you'll want a copy. It offers many valuable clues to getting war orders — an example of how ARMCO is helping enamelers in these difficult days.

If we haven't mailed you a copy, write for one today on your company letterhead. We'll also be glad to send you a list of correct addresses of your nearest military purchasing prospects. The American Rolling Mill Company, 1711 Curtis St., Middletown, Ohio.

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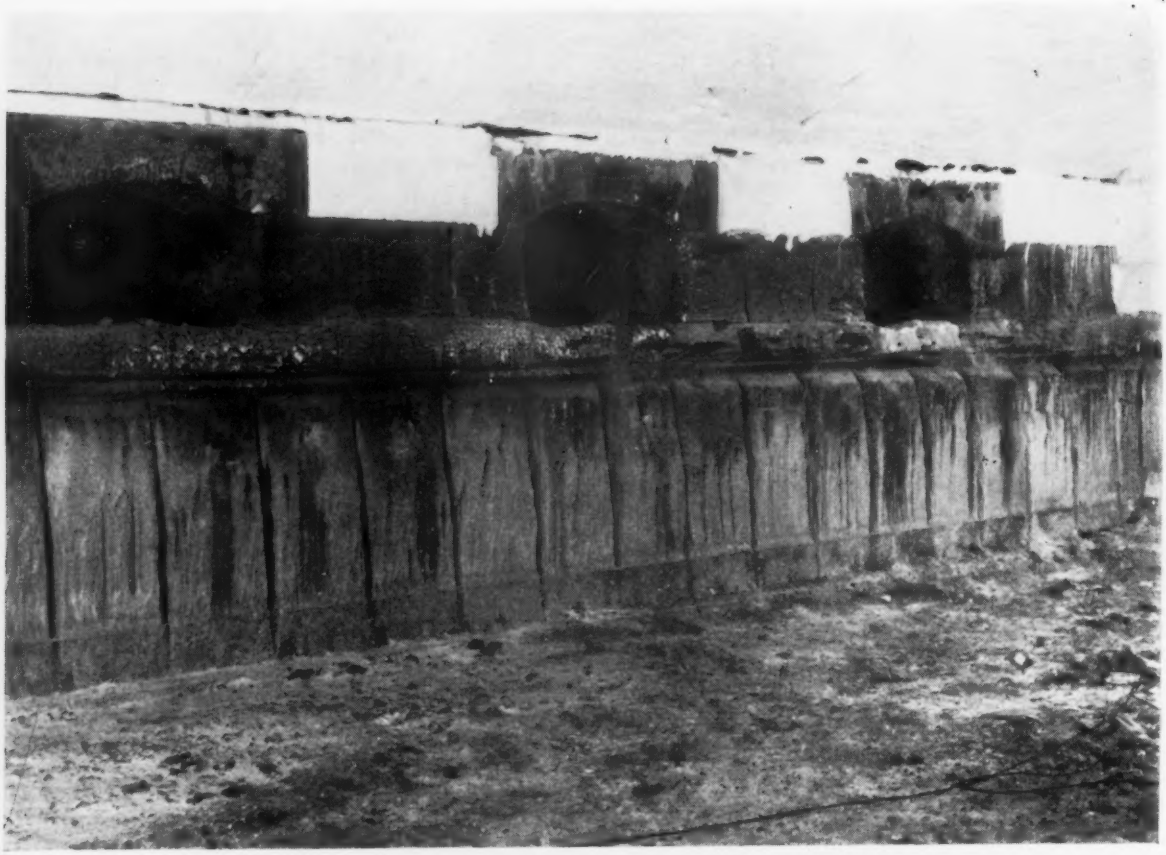

A Typical Corhart* Electrocast Performance . . .

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This, we believe, totals up to a fairly typical performance of furnaces built with Corhart* Standard Electrocast. And while the life-span was not in any way spectacular, it is obvious that the life of this tank was not terminated by any Corhart product. We would be glad to send you performance data on furnace operations similar to your own.

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CERAMIC ABSTRACTS

Compiled by

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JOURNAL REFERENCE: The journal name appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 21 June 15, 1942 No. 6

Abrasives

Mechanical polishing with a film of abrasive. F. L. STILLWELL. *Econ. Geol.*, **37** [1] 76–78 (1942).—In polishing specimens on revolving lead laps, any excess abrasive or lubricant must be squeezed out, leaving only an abrasive film of uniform thickness between the specimen and lap. A polishing machine providing sufficient pressure (about 10 lb. per in.^{2}) to secure the desired results is described and illustrated. Pressure is applied through a ball joint to insure a uniform distribution. Abrasives used are graded 303½ optical emery and calcined magnesium oxide (the regular reagent grade is unsatisfactory as a polishing powder). B.C.R.

Surface finish. K. W. CONNOR AND D. A. WALLACE. *Aircraft Prod.*, **3** [28] 41–44; [30] 144–48; [32] 209–12; [33] 227–30 (1941); **4** [38] 93–100 (1941); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 152, p. 51 (Feb., 1942).—Work in connection with automobiles and aircraft is described. The following subjects are dealt with: relation of friction and lubrication to surface finish; effect of various abrading operations on the microstructure of surfaces; measurement of surface finish; honing and its application to aero-engine cylinders, master connecting rods, and other aircraft components; and the superfinishing process.

Surface finishing and structure. J. WULFF. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1318; *Metals Tech.*, **8** [4] 6 pp. (1941); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 146, p. 225 (Aug., 1941); see *Ceram. Abs.*, **20** [9] 211 (1941).

Use of noble corundum for grinding materials having low tensile strength. FRITZ KÜLPMANN. *Schleif- & Poliertech.*, **16** [8] 150–51 (1939).—Practice has shown that it is possible to grind aluminum, red brass, copper, chill castings, gray-iron castings, cast iron, tempered and untempered steel, coal, refractory block, and other materials having low tensile strength with abrasive bodies containing noble corundum or bodies in Dilumit-X bonding. Noble corundum abrasives are 40% more efficient than silicon carbide abrasives, and their manufacture in the form of disks and bodies is comparatively simple and rapid. See "Grinding. . . ," *Ceram. Abs.*, **19** [6] 132 (1940). M.V.C.

PATENTS

Abrasive-projecting apparatus. N. J. QUINN (Quinnex Corp.) U. S. 2,279,342, April 14, 1942 (May 25, 1935).—In abrasive-projecting apparatus, the combination of two spaced rotatably mounted disks having yieldable coatings on their adjacent surfaces, the coatings being provided with radial recesses and being arranged with such surfaces in at least partly opposed and cooperative relationship, means for feeding abrasive angularly to the recesses in each of the disks, and means for synchronously rotating the disks.

Abrasive wheel. ALBERT STRASMANN (Albert Strasmann Präzisions-Werkzeug- und Maschinenfabrik). Ger. 706,004, April 10, 1941; 67*c*. 1; *Chem. Abs.*, **36**, 2106 (1942). Addition to Ger. 702,317 (see "Restoration. . . ," p. 116).—An abrasive wheel is made of Al. The working surface is roughened and hardened by electrically oxidizing it.

Abrasive wheel for making decorations and effects on metallic surfaces. FRANZ MUSIL. Austrian 157,572, Dec. 11, 1939; 49*a*; *Chem. Abs.*, **36**, 2106 (1942).

Buffing wheel. R. A. GARLING (Bruce Products Corp.). U. S. 2,280,399, April 21, 1942 (Nov. 20, 1940).

Built-up abrasive. J. C. DRADER (Michigan Tool Co.). U. S. 2,281,420, April 28, 1942 (April 15, 1936).

Coated abrasive. W. C. WARE (M. R. Ware). U. S. 2,278,158, March 31, 1942 (June 24, 1940).—A flexible abrasive sheet for use under conditions developing high abrading-surface temperatures.

Coated abrasive article. N. P. ROBIE (Carborundum Co.). U. S. 2,280,852, April 28, 1942 (Feb. 24, 1938).

Diamond abrasive tool. E. W. ENGLE (Carboloy Co., Inc.). U. S. 2,277,428, March 24, 1942 (May 31, 1939).

Diamond-polishing wheel. JULIUS DINHOFER. U. S. 2,279,940, April 14, 1942 (Dec. 4, 1940).

Grinder. HANS PETERSEN (Storm Mfg. Co., Inc.). U. S. 2,277,144, March 24, 1942 (Jan. 29, 1940). H. H. ROAKE. U. S. 2,279,494, April 14, 1942 (July 22, 1940).

Grinding or abrading machine. ARTHUR SCRIVENER. U. S. 2,277,417, March 24, 1942 (June 9, 1941).

Grinding disk. A. H. GRAENSER (D. E. Meyer). U. S. 2,279,673, April 14, 1942 (May 25, 1940). I. R. SHUE

(Gardner Machine Co.). U. S. 2,279,278, April 7, 1942 (March 17, 1939).

Grinding machine. J. H. HOERN AND E. J. GABRIEL (Eaton Mfg. Co.). U. S. 2,278,784, April 7, 1942 (Feb. 13, 1939). H. E. SOMES (Budd Induction Heating, Inc.). U. S. 2,277,373, March 24, 1942 (April 8, 1939).

Grinding machine table positioning mechanism. H. F. WIDENER AND G. T. MUSKOVIN (Norton Co.). U. S. 2,277,028, March 24, 1942 (Nov. 17, 1941).

Grinding and polishing machine. W. S. HOWE (Production Machine Co.). U. S. 2,277,644, March 24, 1942 (July 28, 1939).

Grinding wheel. H. E. BAUER (Abrasive Co.). U. S. 2,278,301, March 31, 1942 (Feb. 12, 1941).

Grinding wheel. L. H. MILLIGAN AND R. H. LOMBARD (Norton Co.). U. S. 2,281,525, April 28, 1942 (Nov. 19, 1936).—Method of making a diamond abrasive wheel. **U. S. 2,281,526,** April 28, 1942 (May 16, 1940).—A grinding wheel or other abrasive article comprising boron carbide abrasive particles bonded with a ceramic bond having the following formula: 45 to 65 by weight of SiO_2, 15 to 40 B_2O_3, 3 to 20 Al_2O_3, and 3 to 10% of an oxide of alkali metal.

Grinding wheel truing apparatus. JOHN OLSON (Norton Co.). U. S. 2,279,092, April 7, 1942 (Feb. 7, 1941).

Honing machine and method. R. H. CRAMER (General Motors Corp.). U. S. 2,280,379, April 21, 1942 (April 25, 1939).

Honing sticks. MICROMATIC HONE CORP. Brit. 543,-293, March 4, 1942 (May 22, 1939).

Internal grinding and honing machine. B. E. HANSON (Heald Machine Co.). U. S. 2,277,589, March 24, 1942 (Aug. 29, 1940).

Knife-sharpening mechanism for cutting machines. F. J. CLARK AND F. G. CLARK (Eastman Machine Co.). U. S. 2,281,023, April 28, 1942 (Jan. 19, 1940).

Lapping arm. H. S. INDGE (Norton Co.). U. S. 2,277,-047, March 24, 1942 (March 17, 1941).

Making coated abrasives. H. C. MARTIN AND C. W. Foss (Carborundum Co.). U. S. 2,277,520, March 24, 1942 (March 2, 1936).

Means for dressing grinding disks. ALFRED RICKENMANN (Reishauer Tool Works, Ltd.). U. S. 2,279,523, April 14, 1942 (Dec. 12, 1938).

Mower sharpener. W. V. SMITH. U. S. 2,281,055, April 28, 1942 (April 2, 1940).

Piston grinding machine. C. J. GREEN (Norton Co.). U. S. 2,279,902, April 14, 1942 (Aug. 14, 1940).

Polishing wheels. ALBERT STRASMANN (Albert Strasmann Präzisions-Werkzeug- und Maschinenfabrik). Ger. 703,139, Jan. 30, 1941; 67*c*. 1; *Chem. Abs.*, **36,** 199 (1942). Addition to Ger. 702,317 (see "Restoration . . . ," this page).—The polishing wheel is made of plastics which remain unaffected by water and oils but which are soluble in alkalis, alcohol, ether, esters, ketones, hydrochlorides, etc. To renovate the wheel it is treated with the suitable solvent and reshaped.

Process of making ceramics, abrasives, etc., from alumina and products thereof. J. A. HEANY (Heany Industrial Ceramic Corp.). U. S. 2,278,442, April 7, 1942 (April 7, 1937).—An amorphous, hard, dense, nonporous, nonfused, noncrystalline, and fired alumina ceramic possessing a conchoidal fracture and no cleavage planes, having a hardness of 71C on the Rockwell scale, a density of 3.68, and a power factor of 0.14, formed of conglomerated coherent alumina particles having a fineness of 5 to 20 microns.

Restoration of polishing wheels. ALBERT STRASMANN (Albert Strasmann Präzisions-Werkzeug- und Maschinenfabrik). Ger. 702,317, Jan. 9, 1941; 67*c*. 1; *Chem. Abs.*, **35,** 8164 (1941).—Used-up polishing wheels made of thermoplastics are restored to their original effectiveness by heating them and reshaping them properly.

Segmental abrasive wheel for pulp grinding. L. A. PATT (Carborundum Co.). U. S. 2,279,486, April 14, 1942 (Dec. 14, 1939).

Thread-grinding machine. W. F. DALZEN. U. S. 2,277,213, March 24, 1942 (April 19, 1941).

Art and Archeology

Activities of the technical ceramic school in Teplitz-Schönau. ANON. *Sprechsaal*, **74** [14] 148–50 (1941).—At the 60-year-old school, instruction is divided into courses for ceramists, modelers, and ceramic painters. After the first year, which is the same in all three courses, the ceramist receives instruction in ceramic calculations, work in the chemical laboratory, and machinery operation. In the third and last year, the student takes up ceramic machinery, building construction, and firing technique, with practical ceramic laboratory work. Some attention is paid to modeling and ceramic painting. Students in modeling are given experience with clay and plaster, and they learn the effect of light and shade by engraving clay plates. Their own index fingers and thumbs are at first the best tools. Special emphasis is laid on developing in the student an appreciation of plastics. In the second year, the students model fruits, leaves, shells, and branches and later beetles, birds, and living animals when available. Toward the end of the year, studies are made of details of the human body, such as the hands, feet, arms, and ears. In design modeling, details of plants are used in ornamentation, and vases, boxes, bowls, etc., are designed with and without plastic decorations. The design work of the third year is mainly with living models or copies from the old masters. The student makes a plaster mold from his design and casts the object himself. The third course is for ceramic painters who are assumed to have some ability in drawing and a feeling for color. In the first year, the student starts with ceramic pen-and-ink drawing on tile. Next he uses the round paintbrush which shows with what simple means shading can be introduced. In the second year, ceramic objects are decorated with colored glazes. The student does not at first see the final effect, as this is brought out only by the fusing process at about 1060°C. His own experience shows him the results of errors. After obtaining some skill and confidence in working on small objects, he can advance to plastic decoration of large pieces. From several water-color sketches made by the student, the most suitable is selected as a basis for his work. In the latter part of the year, the student makes the necessary glazes and obtains experience in painting on porcelain. The third year is devoted to the study of further painting and decorating techniques and methods required for different raw materials, e.g., underglaze painting on a porous surface or underglaze enamel, painting with colored slips (engobes), and the spraying technique, on or under the glaze. W.H.H.

Animal plastics at the government ceramic craft school in Höhr-Grenzhausen. BETZEL. *Sprechsaal*, **74** [21] 211–13 (1941).—The school is located in the middle of one of the most famous clay regions of the world, and in most cases the native stoneware clay is used. The head of the department of sculpture is A. Kamp, who has had almost 40 years of experience as a sculptor and nearly 30 years of teaching experience. The 9 illustrations are mostly of students' work and should be judged accordingly. As such they are astonishing. A ram, in salt-glazed stoneware, with sparing use of black on the feet and horns, is especially effective. The buffalo has a salt glaze mixed with rutile, and his mane is made simply by pressing clay through a sieve. In all the figures of animals there is something original, mostly some striking expression of animal nature or movement of the body. The three ducklings are evidently alarmed and seek protection from one another. The wire-haired terrier is quite different; he stands stiff and self-conscious. Other animals are of majolica with zinc glaze. The colt reminds us of often-seen, boisterous young animals in the succulent green spring meadows. The great difference in the nature of two apes is well brought out in the figures of a baboon and an anthropoid

ape. Two illustrations of figures by the teacher, a horse and a stork, are given. The horse is the embodiment of strength; the stork, with twinkling eyes, thoughtfully scratches his head. W.H.H.

Art of the potter. GRACE LOVAT FRASER. *Studio*, **122**, 104–108 (1941).—Although the scope of the artist is circumscribed by the properties of pottery bodies, there is more freshness in the pottery industry than in most others. Tableware offers opportunities of new decoration and texture but not new shapes, as the traditional patterns are best. There is an urgent need for cheap, well-designed pottery. Designs by Truda Carter, Arnold Machin, and T. Hassall for well-known English firms are illustrated. L.R.B.

Ceramics in the Biela and Eger valleys. ANON. *Sprechsaal*, **74** [14] 147 (1941).—Excavations in northwest Bohemia have shown that cultured life reaches back to the time of the earliest settlers. After the daily life was supplied with the necessary utensils, there came the need for ornament. Pottery making is to be regarded as one of the oldest trades; potteries have existed for about 5000 years. The first vessels served for practical purposes and were made free hand. After about 1000 years, they were made impervious to water by rubbing them with soot. Since the people of the Stone and Bronze ages were migratory, vessels had to be made portable. They were first hung up by handles, and only later was the bronze base discovered. Forms and ornamentation changed with the development of culture and the introduction of the potter's wheel. At the beginning of historical times, a more careful choice of raw materials can be observed. The crusaders introduced glazing. The establishment of a porcelain factory was an important development in Bohemia. The kaolin deposits and the occurrence of clay near layers of coal assured a quick success for ceramics. See "Decorative . . . ," *Ceram. Abs.*, **17** [7] 242 (1938). W.H.H.

China. ANON. *House Beautiful*, **82** [10] 65–66 (1940).—The production of a piece of dinnerware at the Lenox factory is described, beginning with the clay-mixing room where the white clay is mixed with a flux. The clay is mixed with water, screened, and run over a magnet; the slip is then poured into molds on low revolving tables. Due to constant absorption of moisture, the wear on the molds is so great that they must be made almost as fast as the china and must be big enough to permit a shrinkage of $^1/_8$ on firing. The excess slip is poured out at just the right moment, and the various parts (handles and bases) are assembled with brushes and sponges. Jiggering and drying on a "chum" are described. The ware is placed in saggers in the kiln. The 3-day firing period is followed by a 3-day cooling period. Sandblasting to clean the ware and the application of the glaze by dipping, drying again, and firing for a 38-hr. period are described. Decoration, including decalcomanias, filling in with colors, and spraying on of colors, involves 3 to 12 additional firings. Plant-process pictures and pictures of finished examples from several famous factories are presented. M.E.P.

Commercial art glass. LEO MOSER. *Glass Ind.*, **23** [3] 101–103 (1942).—A series of original modern Bohemian art creations is presented in photographs. M. suggests applications of new American methods to the production of this type of ware. A.P.

Copper engraver, potter, glazier. Question of graphical copying. ALBERT SCHRÖDER. *Sprechsaal*, **74** [11] 119–21 (1941).—Our conception of plagiarism was unknown in earlier times, and engravers in publishing sample books announced in the titles that their productions could be used as patterns for other works of art, without acknowledgment. Dürer, one of the earliest engravers, made a series of designs to serve as patterns for hand workers such as glassmakers and goldsmiths. Holbein did much work of this kind. The ceramist, Statius von Düren, who had a workshop in Lübeck in the middle of the 16th century, furnished many civilian houses with ceramic ornaments made from a red, unglazed clay, the designs being furnished by other artists. Painters on glass followed the same procedure. The design of a two-headed eagle with widespread wings, often placed on tankards, had its origin in a woodcut of 1511 with the inscription "The Holy Roman Empire and all its members." Other tankards show the Emperor and the 7 electors, from the woodcut of Hans Vogel. Mythological scenes, mostly from designs of South German and Netherlands artists, were popular on pottery. Bohemian cut-glass goblets (18th century) furnish another illustration of copying a design, although the glass cutter never slavishly followed the pattern but often combined details from several engravings to make a new pattern suited to his purpose. This was a time of foliage, ribbons, and grotesque designs. The published books of engravings were more numerous even than during the Renaissance. Potters, glass painters, and glass cutters, like other contemporaneous artistic hand workers such as painters and sculptors, availed themselves of a wide range of graphical patterns. This was not due to any inability on the part of the copyist, who often showed that he could evaluate the engraved pattern for his own particular purpose. W.H.H.

Education of the artistic industrial glassworker at the government school for glass decoration at Steinschönau. ANON. *Sprechsaal*, **74** [13] 138–40 (1941).—Many of the graduates of the school at Steinschönau are today workers and advisers to the well-known Bohemian glassmakers, while many are active in foreign lands and can successfully fill any position because of their thorough and many-sided technical training. As glass has so many forms and there are so many methods of forming, it is not possible for one workman to produce a finished article. Skill from more than 25 technical vocations must often be united to produce the best piece of artistic glassware. All the separate operations must be supervised as the piece passes from hand to hand. The students are given general artistic training for making designs and the technical training needed to make the ware. In teaching art, special emphasis is placed on educating the peculiar talent of the individual. The historical development of glass is taught in order to develop a feeling for form, but the artistic aims of today must rest on modern artistic standards. 4 illustrations. See "Bohemian . . . ," *Ceram. Abs.*, **18** [8] 205 (1939). W.H.H.

Glass and ceramics in Alsace and Lorraine. CHARLOTTE STEINBRUCKER. *Sprechsaal*, **74** [11] 117–19 (1941).—Ceramics is an old industry in Alsace-Lorraine. According to records, a potter who died in 1283 was the first in Alsace to cover pottery with glass. Hannong, a tobacco-pipe manufacturer, and Wachenfeld, a porcelain painter, established a majolica kiln in Strassburg in 1721. The Hannong family produced prominent ceramists for many years. Their main accomplishment was the production of majolica which surpassed almost all others of that period in luster and brilliance. A competitive majolica factory was established at Niederweiler, Lorraine, in 1735. This finally (1886) became a stock company, under the name of the Steingutfabrik Niederweiler, making only commercial ware. Glassmaking in Alsace-Lorraine dates back to Roman times. In 1557, Henselt, a glassmaker from Lorraine, established in London the first glassworks to make window glass in England. The first glassworks in Lorraine making plate glass was founded at the beginning of the 15th century in St. Quirin and was the cradle of all the glassworks of France. Work was suspended in the 17th century because of war, but the works were re-established in 1737; a stock company was formed with other glassworks in 1844, and this was moved to Cirey in 1888. Of great significance is the manufacture in Lorraine of glass for clocks and eyeglasses. The works established in Goetzenbrück in 1721 maintain large stocks of their ware in New York, Paris, London, Geneva, and Chaux-de-Fonds. W.H.H.

Kröning folk art as a means to modern art education. WILHELM HEIZER. *Keram. Rundschau*, **48** [27] 221–23 (1940).—The district of Kröning was long celebrated for its handmade pottery, and the knowledge of the craft was handed down from generation to generation. A collection of this artware and houseware is on display at the Landshut State Ceramic Technical School for purposes of study and instruction. The form of the pieces, perfected through

generations, is the principal object of study, as it serves as a basis for the work of modern ceramic artists. Illustrated. M.V.C.

Omitting pigments and muffle decoration to save important raw materials. BERDEL. *Keram. Rundschau*, **48** [21] 173–74 (1940).—Chromium, manganese, tin, iron, lead, copper, and nickel formerly used for decorating ceramic ware and artware are now required for implements of war in Germany. Substitutes for these metals are difficult, if not impossible, to find, and B. suggests that a new technique of decoration be developed, which would stress the quality of the ware, harmonious form and line of the body, whiteness of the porcelain or whiteware, fired color, transparency, play of light and shadow, and plastic and relief ornamentation. M.V.C.

Patterns from the Pacific. ANON. *House Beautiful*, **83** [11] 80–81 (1941).—This review of California's craftsmen-artists and their work in glass, fabrics, metals, and ceramics includes mention and pictures of Glen Luken's pottery and glazes, Adolf Odorfer's ceramic sculpture, Dorothy C. Thorpe's sand-carved crystal, Gertrude and Otto Natzler's pottery, William Manker's high-gloss semi-porcelains, the Wildenhains' Chinese-type pottery, and the Paradises' "Ginia" ware. M.E.P.

Photolithographic decalcomania now replaces hand lithography and assures faithful reproduction of the artist's original design. ANON. *Ceram. Ind.*, **38** [2] 32–33 (1942).—A new process developed by the E. I. du Pont de Nemours & Co. for making chinaware decalcomanias is described. Illustrated. H.T.

Portraiture in glass staining. J. L. FISCHER. *Diamant*, **63** [11–12] 81–86 (1941).—The art of portraying in stained glass, first developed in the 15th century, found its finest expression in German churches and old castles in the 15th and 16th centuries. Illustrated. See "Zenith . . . ," *Ceram. Abs.*, **20** [5] 111 (1941). M.H.

Practical limitations for one-fire pottery ware. WALTER A. HULL. *Ceram. Ind.*, **38** [3] 41–44 (1942).—In attempting to use one firing for maturing both the body and the glaze of ware, the chief difficulty is cracking of ware after application of the glaze. The presence of a certain amount of ball clay in the glaze gives a better bond. The wall thickness of ware affects its tendency to crack when glazed. H.T.

Projective transformations of color-mixture diagrams. D. L. MACADAM. *Jour. Optical Soc. Amer.*, **32**, 2–6 (1942).—Interest in the projective transformation of color-mixture diagrams has increased as a consequence of attempts to find transformations in which all pairs of colors having equally noticeable differences of color can be represented by pairs of equidistant points. The present I.C.I. standard coordinate system is adequate for the specification of color and color tolerances and should not be abandoned. A.P.

Red man's art. MARIE SETON. *Studio*, **123** [587] 40–44 (1942).—The American Indian tribes are born creative artists, making by hand woven baskets and blankets, silverware, pottery, and decorated costumes. An unusual pottery is at Jemez, New Mexico, where a woman potter has developed original clay portrait figures, vividly painted, and groups of figures set within three walls of pottery houses. 12 illustrations. L.R.B.

Reducing fire for glazes. ANON. *Keram. Rundschau*, **48** [38] 313–14 (1940).—The procedure necessary to obtain the reducing fire required for art glazes is outlined. M.V.C.

Tureens. MICHAEL BIRKENBIHL. *Keram. Rundschau*, **48** [30] 245–47; [32] 263–64; [33] 271–73 (1940).—Soup tureens from historic and modern services are illustrated and described with regard to details of decoration, coloring, styles in covers, handles, and feet. The most beautiful and celebrated service in the world is the Meissen rococo Swan service given by King August III to his minister Count Brühl in 1737. Next in importance is the Flora Danica service (*Ceram. Abs.*, **15** [1] 3 (1936); "Danish . . . ," *ibid.*, **20** [1] 4 (1941)) from the Royal Factory in Copenhagen. It was begun in 1790 and was to be a gift for Catherine II of Russia, but her death occurred before its completion. The complete service contained 2528 pieces, most of which are now in Rosenburg Castle. In 1770, Dominikus Auliczeck modeled the charming classical Lorbeer service for the Nymphenburg State Porcelain Factory. Other well-known services are also described. Modern styles of tureens have abandoned the ornate and rococo decorations and possess quieter lines and little marking except for edging lines; some manufacturers, however, still copy old styles. Circular forms with flat or conical covers are popular today. M.V.C.

Work of the government craft school for the glass industry in Zwiesel: I, Engraving. MAUDER. *Sprechsaal*, **74** [17] 175–76 (1941).—The Zwiesel school has endeavored for twenty years to suit the decorations to the form of the object. To build up a system of decoration, a start was made with simple elements; in the course of years, a large number of appropriate types of ornamentation were developed. Emphasis is placed on proficiency in handwork and on inspiring the students with honesty and conscientiousness. It is of the greatest importance to teach the students all the principal methods of glass cutting, both old and new. Three illustrations are given of cut-glass vases. **II, Glass cutting.** *Ibid.*, [18] 183–84.—By indentations of all kinds, a strong reflection of light peculiar to glass is produced. There are almost unlimited possibilities of beautifying glass by cutting, there being three steps in the process. The pattern is first roughed out with the iron wheel and coarse sand or silicon carbide. Fine grinding is done with the stone wheel, using only water. The glass is then polished with the wooden or cork wheel and polishing materials. Glass cutting, as well as engraving, is a very old art, which was developed by the Romans with excellent results. The art of decoration follows regular laws. With regard to the decoration of forms, a recent book by W. von Wersin on elementary ornamentation and its laws is of interest. **III, Hollow glass painting.** *Ibid.*, [19] 195–96.—In glass painting, mostly gay colors are used which may or may not be in relief. The tendency at present is to avoid many colors. Vividness of color is found only on glassware for peasants. Gay colors are less objectionable on ceramic ware, which is a coarser material than glass. At one time hardly any glass was left undecorated, but the present tendency is toward less decoration. The Zwiesel school has developed a system of decoration by fine lines which has attained widespread popularity. The lines are laid out with great accuracy by means of a dividing machine. See *Ceram. Abs.*, **19** [7] 153 (1940). W.H.H.

Work of the government craft school for the porcelain industry in Karlsbad. W. OSWALD. *Sprechsaal*, **74** [16] 165–66 (1941).—The school was founded in 1925, and Karlsbad was the location selected because there had been porcelain works in the neighborhood since 1790. The deposits of Zettlitz kaolin led to the making of high-grade ware which is well known. Some of the artistic uses of porcelain are illustrated. W.H.H.

X-Z planes in the 1931 I.C.I. system of colorimetry. E. Q. ADAMS. *Jour. Optical Soc. Amer.*, **32**, 168–73 (1942).—Various methods of plotting color data including a new type of "chromance" diagram are presented, using Munsell colors as samples. A.P.

PATENTS

Ceramic pigments. OTTO KRAUSE. Ger. 706,656, April 30, 1941; 80*b*. 23.03; *Chem. Abs.*, **36**, 2105 (1942).—Underglaze or overglaze ceramic colors are obtained by using compounds of the type A_2BO_4, where A is one or mixed univalent ions of Li, Na, Cu, or Ag and B is one or mixed sexivalent ions of Cr, Mo, W, or U. The ions are used in such proportions that, upon firing, crystals of the spinel type are formed, $A_2^{I}B^{VI}O_4$. These colors can be used in combination with crystals of the spinel type having the structure $A_2^{III}B^{II}O_4$ and $A_2^{II}B^{IV}O_4$. For these, ions having small radii, such as Be, Mg, Si, or Ge, are used.

Designs for:

Bottle. M. S. IREYS (Armstrong Cork Co.). U. S. 132,180, April 28, 1942 (Dec. 17, 1941). W. J. LUNDY (Olean Glass Co.). U. S. 132,128, April 21, 1942 (July 22, 1941).

Centerpiece. C. W. SAWYER (Libbey Glass Co.). U. S. 132,035, April 14, 1942 (Sept. 25, 1941).

Cigarette container. A. J. ACKERMAN (New Martinsville Glass Mfg. Co.). U. S. 132,120, April 21, 1942 (Aug. 2, 1941).

Combination glass dish, cover, and base. LOUIS POGLEIN (McKee Glass Co.). U. S. 131,965, April 7, 1942 (June 4, 1941).

Combined plate and saucer. H. N. IPSEN. U. S. 132,100, April 21, 1942 (Dec. 12, 1941).

Glass tumbler. BELLE KOGAN (Federal Glass Co.). U. S. 132,021, April 14, 1942 (Feb. 3, 1942).

Goblet. C. W. SAWYER (Libbey Glass Co.). U. S. 132,042, April 14, 1942 (Sept. 25, 1941).

Plate. J. W. MACKEY (Paden City Pottery Co.). U. S. 132,101 and 132,102, April 21, 1942 (Nov. 28, 1941). D. M. MILLER. U. S. 132,012, April 14, 1942 (Aug. 8, 1941).

Glass colors of high alkali resistance. A. J. DEYRUP (E. I. du Pont de Nemours & Co.). U. S. 2,278,868, April 7, 1942 (May 21, 1940).—An alkali-resistant, high lead-content glaze composition suitable for decorating glassware and maturing below about 1150°F. to a glossy, decorative surface coating, the glaze composition comprising lead oxide, silica, an oxide of an alkali metal having an atomic weight not exceeding 40, boric oxide, and zirconium dioxide, the zirconium dioxide being present in amounts ranging from 1 to 10% by weight, based on the total weight of the composition, and being melted into the composition together with the other ingredients specified.

Lead-free glaze of low maturing temperature for use in decorating ceramic ware. A. J. DEYRUP (E. I. du Pont de Nemours & Co.). U. S. 2,278,867, April 7, 1942 (May 1, 1940).—A lead-free vitrifiable ceramic glaze composition which comprises silica in amounts ranging from 40 to 60, boric oxide 20 to 40, aluminum oxide 5 to 15, lithium oxide 1 to 2.5%, and an alkali-metal oxide selected from the group which consists of sodium oxide and potassium oxide, the alkali-metal oxide being present in amounts ranging from 2 to 6%, all percentages being by weight based on the total weight of the glaze composition.

Pigment for coloring ceramic compositions. C. G. GEARY (E. I. du Pont de Nemours & Co.). U. S. 2,278,872, April 7, 1942 (Aug. 1, 1940).—A process of preparing a ceramic pigment which comprises calcining a base mixture including compounds of chromium and antimony in the presence of a sulfate.

Thickening agent for engobes and glazes. FRIEDRICH CRÖSSMANN, JULIUS STAWITZ, AND JULIUS VOSS (Kalle & Co. Akt.-Ges.). Ger. 705,171, March 13, 1941; *80b*. 23.03; *Chem. Abs.*, **36,** 2106 (1942).—Water-soluble cellulose ethers, containing no more than 2.5%, but preferably none, of Me groups, are used to thicken ceramic engobes and glazes.

Cements

Comparative tests of the fineness of cements. F. M. LEA. *Jour. Soc. Chem. Ind.* [London], **58** [4] 146–48 (1939).—Results of an international cooperative test, by six laboratories, of the various methods of determining the fineness of cements are reported. Three cements were distributed, and their fineness was measured by the methods normally employed in the cooperating laboratories, chosen from the photoelectric sedimentation, pipette sedimentation, and air elutriation methods. The agreement is promising and would be improved by attention to the method of dispersion and the employment of standard methods of presenting the results. L.R.B.

PATENTS

Acidproof cements. LIMMER & TRINIDAD LAKE ASPHALT CO., LTD., AND D. C. BROOME. Brit. 543,620, March 18, 1942 (Sept. 9, 1940).

Fire-resistant composition. H. K. LINZELL AND J. W. GILL (U. S. Gypsum Co.). U. S. 2,278,455, April 7, 1942 (Nov. 18, 1938).—A fired ceramic product comprising particles of calcined gypsum bonded by a glasslike binder.

Enamel

Antimony-free frits give better finish, release critical materials for war. HENRY L. FIELDS. *Ceram. Ind.*, **38** [2] 64 (1942). H.T.

Cleaning enameling stock more thoroughly and quickly. D. J. BENOLIEL. *Ceram. Ind.*, **38** [2] 62–64 (1942).—A rust-preventive coating on sheets reduces pickling time. The use of proper fat in the drawing compound speeds cleaning, and precleaning solvents, such as combinations of wetting agents and soap combined with 10 parts of kerosene, cut the cleaning time from 20 min. to 5 min. H.T.

Controlled oxidation enamel furnace reduces defects in ware. WESLEY G. MARTIN. *Ceram. Ind.*, **38** [2] 74–78 (1942).—A two-chamber enamel furnace at the A. O. Smith Corp., Milwaukee, controls the oxidation of base metal. The furnace is built on the principle that a certain amount of oxidation of the base metal is necessary in enameling to develop best adherence. It is used for firing porcelain-lined tanks for domestic water heaters. Illustrated. See *Bull. Amer. Ceram. Soc.*, **20** [12] 430–34(1941). H.T.

Enamel-shop operation under present restrictions on materials. HERMAN L. COOK. *Ceram. Ind.*, **38** [3] 54–56 (1942).—C. believes that all materials shortages for frit manufacture can be remedied by substitutions. Sandblasting is recommended for de-enameling defective pieces. H.T.

Fewer but better finishes. A. L. PIPPER. *Metal Finishing*, **40** [3] 158–62 (1942).—P. describes the methods used by the Radio Corporation of America to control finishing operations. The four tests for determining acceptability are as follows: (1) abrasion, (2) scratch hardness, (3) flexibility, adhesion, and (4) coverage and sec. required for spraying one sq. ft. Details of these tests are given. H.K.R.

Influence of fineness of grinding on the use of boron-free wet enamel. ANON. *Sprechsaal*, **74** [12] 130–31 (1941).—The use of boron-free enamel may require new methods. Its consistency is peculiar. The consistency of a slip depends on the composition of the enamel, the mill additions, the grinding process, the temperature used in applying the enamel, and the fineness of grinding. Most of these factors act differently with boron-free enamel than with enamel containing boron. Boron-free mixtures must in general be less thoroughly melted. Changes must also be made in the methods of using boron-free enamels. The contention, however, that similar difficulties are not encountered with enamels containing boron is explained on the ground that we do not notice difficulties to which we are accustomed. With boron-free enamel, the coat may be uneven, and this cannot be remedied by diluting the enamel. For enamel containing boron, the ground coat for sheet metal is ground coarser than the cover coat, and the wet enamel for cast iron is of medium fineness. This must be changed for boron-free enamels, all of which must be coarsely ground. Finely ground boron-free enamel, when fired, always shows the so-called acid lines or acid stripes and sometimes even crazing. With enamel containing boron, the known remedy for lack of homogeneity and quick settling is to increase the amount of clay at the mill or to decrease it in the case of the formation of streaks and clouds. This does not work well with boron-free enamel, and the best remedy is to grind the enamel coarser and to raise the amount of clay. Coarse grinding is also helpful if difficulty is experienced with bodies which may be either too stiff or not stiff enough. The determination of fineness of grinding by feeling is not accurate enough; instruments are available and should be used. To more readily control the fineness of grinding, the number of balls may be kept

the same as usual and the charge of enamel increased. An increased amount of water may be used in grinding. For a specially stubborn slip, water glass, dextrine, or sugar may be added to the mill. It is advantageous to keep the slip at constant temperature the year round, and final adjustments in the slip should be made just before it is delivered to the enameling shop. The temperature of the sheet or cast iron to be coated should be kept within predetermined limits. See "Difficulties . . . ," *Ceram. Abs.*, **21** [2] 36 (1942); "Effect . . . ," *ibid.*, [4] 77. W.H.H.

Iron oxide in enamel glass as dissolved from the metal base. ANDREW I. ANDREWS AND HOWARD R. SWIFT. *Jour. Amer. Ceram. Soc.*, **25** [9] 217–22 (May, 1942).—4 references, 9 figures.

Large enameling furnace at Falkirk. ANON. *Gas Jour.*, **223,** 797 (1938).—The first continuous enameling furnace heated by gas-fired radiant tubes to be erected in Europe is described. The furnace has a production figure of 4500 lb. of cast iron per hr. and 1600 sq. ft. of sheet per hr. It has a firing zone 40 ft. long and an over-all length of 140 ft. The fuel required shows that a therm of gas is equivalent to at least a gallon of oil, which was previously used. L.R.B.

Titanium oxide as an ingredient of porcelain enamel frits. S. G. TINSLEY. *Ceram. Ind.*, **38** [3] 36–39 (1942).—In certain frits, titanium dioxide may be used as sole opacifier. It materially aids resistance to acids and increases thermal expansion and finish gloss. H.T.

PATENTS

Enamel. VEREINIGTE CHEMISCHE FABRIKEN KREIDL, HELLER & CO. NFG. Austrian 156,822, Aug. 25, 1939; 48*c*; *Chem. Abs.*, **36,** 2107 (1942).—A white powdered enamel is made of MgO, CaO, and ZrO_2. The first two are added as dolomite free of Fe.

Enamel for iron. MAX GROTH (Vereinigte Chemische Fabriken Kriedl, Heller & Co. Nfg.). Ger. 707,050, May 8, 1941; 48*c*. 2.01; *Chem. Abs.*, **36,** 2108 (1942).—To the enamel are added substances which produce gases when the enamel is fired, but these gases are not reduced by the C in the iron. Among such substances are tar, asphalt, resins, pitch, etc.

Method of making enameled containers. J. A. BOHNSACK (Porcelain Steels, Inc.). U. S. 2,281,407, April 28, 1942 (April 25, 1939).

Opacifier for enamels. WALTER KERSTAN (Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler). Ger. 705,665, March 27, 1941; 48*c*. 2.02; *Chem. Abs.*, **36,** 2106 (1942).—Ce compounds mixed with Al_2O_3 in the molecular proportion $CeO_2:Al_2O_3 = 1:0.5$ to 1.2 are used as opacifiers for enamels. **Ger. 707,051,** May 8, 1941; 48*c*. 2.02; *Chem. Abs.*, **36,** 2106 (1942).—Sb oxide with an O content between that of Sb_2O_4 and Sb_2O_5 is used as an opacifier for enamels. This is obtained by heating Sb_2O_5 at 450° to 600° for 1 to 2 hr. or more until a yellow-colored product is obtained, by heating the lower oxides under O pressure, or by heating the antimonates with acid.

Vitreous enamel coated steel article and method of making. H. R. BELDING AND J. A. ECKEL. U. S. 2,279,935, April 14, 1942 (Oct. 7, 1939).—A method of producing vitreous enamel coated steel articles, which includes producing oxidized molten steel containing less than 0.07% carbon and less than 0.30% manganese, adding titanium thereto in amounts insufficient to kill the steel, solidifying the unkilled steel, producing cold-rolled steel from the steel when it solidifies, producing the desired articles from the cold-rolled steel, and fusing vitreous enamel coatings on the articles.

Glass

Cadmium-, selenium-, and sulfur-containing glasses with sharp cut-off and high total light transmission. J. E. STANWORTH. *Jour. Soc. Glass Tech.*, **25** [107] 95–99T (1941).—S. discusses two glasses containing cadmium, sulfur, and selenium which have a sharp cut-off at 5400 and 5900 a.u. when blown into the form of bulbs with a wall thickness of 1 mm. R.H.B.

Changes in spectral transmission of soda silica glass caused by the addition of lampblack and graphite. W. M. COHN. *Glass Ind.*, **23** [3] 95–98 (1942).—Varying amounts of lampblack and graphite were added to a glass of the formula $1.0Na_2O:2SiO_2$. The spectral transmissions were determined photographically by the neutral-wedge method from 3600 to 12,000 a.u. The coloring action of carbon is attributed to a shift of the absorption limit at short wave lengths and a shift of the maximum of transmission. Reference is made to similarities in the absorption spectra of soda-silica glass colored by lampblack and glucose "glass." A.P.

Colored glass—green color. BRUNO SCHWEIG. *Glass,* **18** [12] 348–49, 359 (1941).—S. discusses the production of green glasses, giving several batch compositions. See *Ceram. Abs.*, **21** [5] 99 (1942). B.C.R.

Conditions encountered in filling pressure ware. JOHN M. SHARF. *Jour. Amer. Ceram. Soc.*, **25** [9] 228–30 (May, 1942).

Dampness of packed glassware. ANON. *Sprechsaal,* **74** [15] 157–59 (1941).—Packing is expected to prevent breakage and to prevent glassware from becoming moist in transportation. Many controversies arise as to who is to blame when damage is caused by moisture. The manufacturer desires to convince the customer that the goods became moist in transit and that the railroads are responsible. Ordinarily, the trouble is due to condensation of atmospheric moisture. Heavy masses of glass cause greater condensation than thin glassware. Condensation is especially noticeable in spring when there are great fluctuations in temperature. It is proved by calculation that the condensed water may easily amount to 0.3 to 1% of the weight of the glass, and it may be much more if the changes in temperature are repeated. This moisture is absorbed by the material in which the glass is packed. Those concerned with the shipping of glassware should realize that wetness of the packing material is due to natural causes, and they should take the necessary precautions. W.H.H.

Diffusion of air through translucent fused silica. BURROWS MOORE AND R. BROWN. *Jour. Soc. Chem. Ind.* [London], **58** [4] 142–46 (1939).—The rates of diffusion of atmospheric air through walls of three types of fused silica tubes, viz., a standard translucent tube, a translucent tube g azed outside, and a similar tube with a transparent lining, were compared. Measurements were made at 20°, 500°, and 1000°C., and the values at intermediate temperatures were interpolated. The glazing and still more the transparent lining reduce diffusion. Evidence of some molecular change to the crystalline form at 1000°C. was obtained. L.R.B.

Dispersion of optical glass. M. HERZBERGER. *Jour. Optical Soc. Amer.*, **32,** 70–77 (1942).—Initiated by the question of whether the focal length of a photographic objective for different wave lengths in the infrared could be calculated if the focal length for some part of the visible spectrum were known, this investigation leads to the assumption that silicate glasses have two absorption bands in the near ultraviolet, probably around 2000 and 1600 a.u. As quartz is transparent far beyond these wave lengths, silicate glasses must contain silica in a special form. The agreement of the equations developed to match all the data available for commercial optical glasses indicates that some unknown physical laws are responsible for the dispersion curve of a glass. A.P.

Effect of shape on the bursting strength of tubes. W. M. HAMPTON. *Jour. Soc. Glass Tech.*, **25** [108] 121–35T (1941).—H. presents a theoretical and physical basis for expressing the stress developed by internal pressure in elliptical and rectangular tubes and in two cross sections with rounded corners. The practical application of the

relationship with regard to minimizing the effect of bursting pressures of the walls is emphasized. R.H.B.

Electrical conduction in the glass insulation of resistance thermometers. HAROLD J. HOGE. *Jour. Research Nat. Bur. Standards*, **28** [4] 489–98 (1942); RP 1466. Price 5¢.—At temperatures above 350°C. electrical conduction may become troublesome in the glass through which the leads of certain types of resistance thermometers are sealed. Conduction in these seals is rapidly reduced by polarization of the glass, and the error in temperature measurement resulting from conduction in the glass may be considerably reduced by adopting a measuring schedule which takes full advantage of this polarization. One type of glass was investigated under experimental conditions which prevented polarization. At 445°C., this glass had a volume resistivity of approximately 21,000 ohm-cm. R.A.H.

Electric strengths of solid dielectrics under impulse voltages. W. G. STANDRING. *Jour. Inst. Elec. Engrs.* [London], **88** [4] 360–65 (1941).—The impulse electric strength, under different conditions, of mica, window glass, Mycalex (powdered glass and mica), Panilax (synthetic resin), Pyrex brand glass, and Micanite was measured. L.R.B.

Expansion characteristics of glasses for sodium vapor lamp seals. J. E. STANWORTH. *Jour. Soc. Glass Tech.*, **25** [109] 159–63T (1941).—S. discusses the thermal expansion characteristics of the individual glasses required to give a composite glass in sodium vapor discharge lamps. Experiments revealed that the mechanical strength of the sheathing glass is an important factor in successful construction. R.H.B.

From cotton field to bottle plant in 95 days. ANON. *Glass Ind.*, **23** [3] 91–93 (1942).—The Knox Glass Co.'s new factory in Palestine, Texas, was producing bottles 95 days after the ground was broken. The use of arched trusses facilitated construction and gave better vision and more head space. The 90-ton furnace has 4 ports and is side-fired. It supplies four Lynch 10, one Lynch JP, and one Lynch JPM machines. A.P.

Glass as an insulating material. H. KIEFER. *Arch. Wärmewirt.*, **22** 113–15 (1941); *Brit. Chem. & Phys. Abs.–B*, **I,** 379 (Sept., 1941).—The production and applications of glass wool are described.

Influence of boron oxide on expansibility. ANON. *Glass Ind.*, **23** [3] 107 (1942).—The "anomalous" behavior of boron oxide is more correctly described as a shortcoming of the additive theory. Since predictions of the effect of boron oxide additions to any specific glass composition are not possible, it is better to rely upon trends shown by actual determinations at several stages in a given range of composition. A.P.

Inventor of wave-free flint glass. F. HANSEN. *Diamant*, **63** [7] 50 (1941).—H. presents a short biography of Joseph Fraunhofer; his work in glass composition as precursor to Schott and Abbe is discussed. M.H.

Large plate-glass melting furnace operates 905 days without shutdown. ANON. *Ceram. Ind.*, **38** [3] 30–32 (1942).—A continuous glassmelting tank at the Ford Motor Co.'s River Rouge plant set a record run of 905 days. The tank is built of fire-clay flux block and has a silica crown which is laid up dry; sillimanite brick are used for the top checker chamber course. It is heated by a TECO luminous flame with controlled combustion air and uses a briquette batch. Illustrated. H.T.

Lenses for aerial photography. R. KINGSLAKE. *Jour. Optical Soc. Amer.*, **32,** 129–34 (1942).—K. presents a historical review of the development of aerial photography and discusses the three main fields for lenses, viz., (*a*) military reconnaissance, (*b*) night photos, and (*c*) aerial surveying. In strong contrast to World War I, thousands of aerial lenses of many sizes and types are already being manufactured in the U. S. from domestic glass. A.P.

Methods of testing volumetric glassware. J. J. MORAN. *Proc. Amer. Soc. Testing Materials*, **41,** 492–97 (1941). R.A.H.

Mirror making goes modern. ANON. *Ceram. Ind.*, **38** [2] 56–58 (1942).—The Ford City, Pa., plant of the Pittsburgh Plate Glass Co. is considered the most efficient in the mirror industry. Conveyerized air-conditioned mirror production processes mirrors from start to finish in 90 min. Illustrated. H.T.

Modern mechanical cooling oven. ZWEILING. *Sprechsaal*, **74** [20] 203–204 (1941).—All glassware should be carefully and evenly cooled. Too-rapid cooling leaves tensions which later cause apparently unexplainable breakage. The older chamber cooling ovens were placed near the glass furnaces, and the heat and fumes from the furnaces were objectionable to the attendants of the cooling ovens. The tunnel cooling oven was a great improvement where it could be installed. A cooling oven made entirely of metal originated in the U. S. about 1925. This original oven did not, however, prove satisfactory in Germany as the operating expenses were too high, and a more economical oven was developed in the last decade. The Imag mechanical oven is simple to operate and is not too easily damaged; it can be easily installed in old factories as it takes up much less room than cooling ovens of old design of the same capacity. The loss of heat is reduced to a minimum. The metal parts are covered with plates of silicon carbide and fire clay; this prevents them from coming in contact with and being corroded by gases containing sulfur. The oven is built for heating with generator gas, coke-oven gas, natural gas, or oil, or it may be electrically heated. The glassware passes through the oven on a conveyer belt and may be inspected when it leaves the oven; under the older system, it could not be determined until the next day whether salable goods were being produced. The oven may be arranged so that the attendants can work while seated, and this has made it possible to employ women as attendants. W.H.H.

Nature of a polished surface. LLOYD MOTZ. *Jour. Optical Soc. Amer.*, **32,** 147–48 (1942).—By subjecting the polished surface on glass to the action of dilute hydrofluoric acid, it can be demonstrated that it is different in structure from the underlying glass. Scratches which have been rouge-polished until no traces could be discerned, even under a microscope, reappear after such an etching. This result is taken as proof that the polishing process is a molecular phenomenon. Polished surfaces may degenerate with weathering. Reflection-reducing films on glass, produced by dilute nitric acid treatment, did not show reappearance of scratches. A.P.

Optical problems facing the Navy. S. S. BALLARD. *Jour. Optical Soc. Amer.*, **32,** 123–28 (1942).—The greatest optical problem facing the Navy is procurement. Production shortcuts and improved mass-production methods must be found, such as optical plastics as a supplement for glass and laminated ray filters for solid glass. The two major uses of optical gear, navigation and fire control, are discussed. The application of nonreflecting films on the optical surfaces of binocular lenses and other instruments is becoming a routine production matter. Infrared is being utilized. Variable-density neutral Polaroid filters are being applied to telescopes and range finders. A.P.

Protection of the glassworker. ANON. *Sprechsaal*, **74** [10] 103–105 (1941).—Various means for protecting glassworkers are given. The following subjects are discussed: leather cuffs for glass cutters, dust masks for workers who handle raw materials, a water-cooled shield for the door of the melting furnace, charging ladle, correct posture and lighting for grinding glass vessels, good illumination for weighing, spraying of fragments to prevent glass dust, removal of dust by suction directly at the source, protection of hands and feet against acids, a protected chain drive on a conveyer, and transportation of plate glass by the aid of elastic suction cups connected to a vacuum hose. 20 illustrations. W.H.H.

Sampling and testing of sands for making colorless glass. A. SHERLOCK. *Jour. Soc. Glass Tech.*, **25** [107] 87–94T (1941).—S. considers the sampling of sand to be vital to the production of colorless glass; several important considerations are stressed. A 10-lb. sample, well selected, is ample for a wagonload of sand. Sieving, general analysis, clay content, and iron content are dis-

cussed. The use of potassium thiocyanate is advocated for iron determinations. R.H.B.

Symposium on physics of pigments and glasses held at Philadelphia. ANON. *Bull. Amer. Ceram. Soc.*, **21** [4] 57–58 (1942).

PATENTS

Apparatus for:

Forming hollow glassware. E. G. BRIDGES. Brit. 543,751, March 25, 1942 (Sept. 10, 1940).

Making glass thread. EDMUND HENRY WELLECH (N. V. Mij. tot Beheer en Exploitatie van Octrooien). Ger. 705,453, March 20, 1941; 32*a*. 25; *Chem. Abs.*, **36,** 2102 (1942).

Making hollow glass articles. H. R. SCHUTZ (Libbey Glass Co.). U. S. 2,280,268, April 21, 1942 (July 9, 1938).

Making yarn from glass fibers. S. M. DOCKERTY AND O. W. WILEY (Akt.-Ges. der Gerresheimer Glashüttenwerke vorm. Ferd. Heye). Ger. 705,452, March 20, 1941; 32*a*. 25; *Chem. Abs.*, **36,** 2103 (1942). Addition to Ger. 675,267 ("Producing . . . ," *Ceram. Abs.*, **18** [11] 297 (1939)).

Manufacture of mineral wool. G. T. PEARCE (Johns-Manville Corp.). U. S. 2,278,092, March 31, 1942 (July 14, 1939).

Batch feeding apparatus. J. H. REDSHAW (Pittsburgh Plate Glass Co.). U. S. 2,281,050, April 28, 1942 (April 11, 1940).

Building wall. P. E. KNUDSEN (Pittsburgh Corning Corp.). U. S. 2,281,072, April 28, 1942 (July 6, 1940).

Conductive coating for glass and method of application. T. W. H. WARD. U. S. 2,280,135, April 21, 1942 (Feb. 21, 1940).—A conductive coating composition for forming an opaque coating of low light reflectivity on glass, etc., comprising metal of the group consisting of nickel, tin, bismuth, cadmium, chromium, and silver in the form of finely divided flakes dispersed in a liquid medium comprising a film-forming organic substance and a volatile solvent therefor.

Cooling of glass articles in tunnel kilns and glass-cooling ovens. FRITZ ECKERT. Ger. 706,674, April 30, 1941; 32*a*. 29; *Chem. Abs.*, **36,** 2103 (1942).

Crane for suspending glass sheets during heating and annealing. KURT VON STOESSER (Deutsche Libbey-Owens-Ges. für Maschinelle Glasherstellung A.-G.). Ger. 705,708, March 27, 1941; 32*a*. 30; *Chem. Abs.*, **36,** 2103 (1942).

Electric furnace for melting glass. E. V. BOREL (Soc. Anon. des Manufactures des Glaces & Produits Chimiques de St.-Gobain, Chauny & Cirey). U. S. 2,277,678 and 2,277,679, March 31, 1942 (Aug. 10, 1937; May 6, 1940).

Electric furnace and melting method. GAMES SLAYTER, F. W. ATKINSON, ED FLETCHER, AND H. V. SMITH (Owens-Corning Fiberglas Corp.). U. S. 2,280,101, April 21, 1942 (March 29, 1940).

Equipment for making hollow glass bodies, e.g., building blocks. R. W. KELL (Corning Glass Works). Ger. 705,145, March 13, 1941; 32*a*. 24.04; *Chem. Abs.*, **36,** 2103 (1942).

Equipment for producing endless glass fiber. ARTHUR MANGER. Ger. 707,140, May 15, 1941; 32*a*. 25; *Chem. Abs.*, **36,** 2102 (1942). Addition to Ger. 699,846 (see "Web . . . ," this issue, p. 123).

Fibrous materials from glass, etc. PIERO MODIGLIANI (Soc. anon. Vetreria Italiana Balzaretti-Modigliani). Ger. 705,362, March 20, 1941; 32*a*. 25; *Chem. Abs.*, **36,** 2103 (1942).—Equipment and procedure are described for the production of fibers from glass and similar materials which become plastic under the influence of heat.

Foam glass building materials. SOC. ANON. DES MANUFACTURES DES GLACES & PRODUITS CHIMIQUES DE ST.-GOBAIN, CHAUNY & CIREY. Brit. 543,882, April 1, 1942 (April 14, 1938).

Frosting glass. D. P. GALLAGHER. U. S. 2,278,257, March 31, 1942 (Nov. 22, 1938).—The process of imparting an inside frost to a glass bulb which comprises subjecting the bulb to a solution comprising substantially 23 hydrofluoric acid, 20 ammonium bifluoride, 4 sodium bicarbonate, 33 denatured alcohol, 10 soda, and 10% water.

Fusing metal foil into quartz. CHARLES GILSON AND J. G. BRETT (Allgemeine Elektricitäts-Ges.). Ger. 705,974, April 3, 1941; 32*b*. 10; *Chem. Abs.*, **36,** 2104 (1942).—A wire is rolled or pressed and subsequently electrolytically etched to the thickness of a foil. This area is then fused into the quartz, e.g., of an electric discharge lamp; the two ends of the wire (not reduced to a foil) are used to connect to the current supply and to the electrode.

Fusion oven for glass, etc. FRITZ ECKERT. Ger. 707,036, May 8, 1941; 32*a*. 1; *Chem. Abs.*, **36,** 2102 (1942).

Glass building block. G. T. MEYERS (Meyers Co.). U. S. 2,281,524, April 28, 1942 (Nov. 25, 1940).

Glass composition and product thereof. E. D. TILLYER, H. R. MOULTON, AND T. M. GUNN (American Optical Co.). U. S. 2,278,501, April 7, 1942 (May 12, 1939).—A substantially colorless light-transmitting medium having the property of selectively absorbing extra visual radiations, the medium being commercially free from compounds of boron, having the contents of silicon compounds less than 1%, and comprising, as a major constituent, an oxide of phosphorus to the extent of at least 50%, with minor quantities of ingredients selected from alkali and alkaline-earth groups and stabilized against chemical attack by means of a stabilizer having the stabilizing characteristics of and comprising an aluminum compound and a beryllium compound and containing compounds for absorbing extra visual radiations.

Glass compositions and seals for sodium vapor electric discharge lamps made therewith. BRITISH THOMSON-HOUSTON CO., LTD., AND J. E. STANWORTH. Brit. 543,441, March 11, 1942 (Jan. 9, 1941).

Glass-cutting apparatus. D. R. LIMBERS (Pittsburgh Plate Glass Co.). U. S. 2,278,273, March 31, 1942 (June 19, 1941).

Glass-handling apparatus. EARL HIATT AND J. J. MACKEN (Australian Consolidated Industries, Ltd.). Australian 109,179, Nov. 21, 1939; *Chem. Abs.*, **36,** 2103 (1942).—A jaw structure for use in connection with automatic take-out machines.

Glassworking apparatus and method. L. D. SOUBIER (Owens-Illinois Glass Co.). U. S. 2,280,167, April 21, 1942 (Dec. 23, 1938).

Laminated glass. F. W. HALL (Pittsburgh Plate Glass Co.). U. S. 2,278,369, March 31, 1942 (June 23, 1939).

Laminated safety glass and plastic therefor. J. D. RYAN (Libbey-Owens-Ford Glass Co.). U. S. 2,279,145, April 7, 1942 (April 28, 1937).

Lamination of glass with other materials. WALTER PEGLER. Australian 108,199, Aug. 7, 1939; *Chem. Abs.*, **36,** 2103 (1942).—A material such as a wood veneer is coated with a transparent adhesive, e.g., vinyl acetate, and on top of this is pressed a sheet of glass. The back side of the veneer may be reinforced with welding, a metal sheet, etc.

Machine for printing on cylindrical glassware. LUIGI MARZOCCHI. U. S. 2,277,597, March 24, 1942 (Dec. 26, 1939).

Manufacture of drawn glass. PETE MAGRINI (American Window Glass Co.). U. S. 2,278,328, March 31, 1942 (April 29, 1938).

Means for applying an adhesive coating to newly formed mineral wool fibers. D. C. DRILL (American Rock Wool Corp.). U. S. 2,280,388, April 21, 1942 (May 27, 1939).

Method and apparatus for manufacture and treatment of glass, etc. E. V. BOREL (Soc. Anon. des Manufactures des Glaces & Produits Chimiques de St.-Gobain, Chauny & Cirey). U. S. 2,281,408, April 28, 1942 (Feb. 11, 1939).

Method and equipment for making pressed glass articles. S. L. LEBBY (Corning Glass Works). Ger. 705,202, March 20, 1941; 32*a*. 17; *Chem. Abs.*, **36,** 2103 (1942).

Method of feeding molten glass. G. T. MEYERS (Meyers Co.). U. S. 2,280,036, April 14, 1942 (Oct. 16, 1939).

Method of making reflecting glass. A. D. NASH (Pittsburgh Plate Glass Co.). U. S. 2,281,076, April 28, 1942 (Nov. 1, 1938).—In the production of reflecting sheet glass containing a relatively small percentage of a silver salt,

the steps comprising melting a glass batch containing a silver salt, forming the molten glass into sheets, and subsequently subjecting these sheets to heat in a reducing atmosphere.

Method of manufacturing glass articles. E. E. SLICK. U. S. 2,278,572, April 7, 1942 (Sept. 26, 1936).

Mold for making curved composite building blocks. E. T. PUTNAM (Libbey-Owens-Ford Glass Co.). U. S. 2,279,178, April 7, 1942 (June 5, 1941).

Ornamental glass. THOMAS ROSS (Crown Crystal Glass Pty., Ltd.). Australian 109,646, Jan. 22, 1940; *Chem. Abs.*, **36,** 2103 (1942).—The degree of transparency of glass is controlled by adding a definite quantity of sand to the molten glass and thoroughly stirring the melt to distribute the sand evenly. If desired, coloring matter may be added in the same manner.

Patterns. RUDOLF LIEPACK (Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler). Ger. 706,117, April 10, 1941; 57*b*. 2.03; *Chem. Abs.*, **36,** 2103 (1942).—Patterns for decorating ceramic or glass articles are made as follows: a photosensitive gelatin pattern is applied on a glass plate. The gelatin is coated with a layer of collodion and exposed. On top of the collodion is spread a sheet of paper; the gelatin collodion paper is lifted off the glass and developed. After developing, a sheet of silk is put on top of the gelatin and the whole is dried, whereupon the paper is removed and the collodion is dissolved out.

Preheating chamber for decorating lehrs. H. R. BLACK (Libbey Glass Co.). U. S. 2,280,306, April 21, 1942 (May 7, 1940).

Process for manufacturing laminated articles. B. J. DENNISON (Pittsburgh Plate Glass Co.). U. S. 2,281,027, April 28, 1942 (July 31, 1940).

Roofing unit and assembly thereof. D. E. GRAY (Corning Glass Works). U. S. 2,279,674, April 14, 1942 (Oct. 19, 1940).

Safety glass. ELEKTRO-OSMOSE (Graf Schwerin-Ges.). Ger. 705,520, March 27, 1941; 39*b*. 27; *Chem. Abs.*, **36,** 2104 (1942).—Plates of glass are bonded by a thin layer of a polymer, e.g., polyacrylic acid ester or polyvinyl acetate, under heat and pressure. The polymer is dissolved in a mixture at least one component of which boils at 100° to 220° and has a relative volatility of over 30 (ether = 1). Among such compounds are diacetone alcohol, methylcyclohexane, and methylglycol acetate. This glass is resistant to cold.

Sealing electric leads into glass. ANTON LUTZ AND FRANZ ZWACK (Siemens-Schuckertwerke Akt.-Ges.). Ger. 680,715, Aug. 17, 1939; 21*g*. 1.02; *Chem. Abs.*, **36,** 2104 (1942).—A mold is described and a method is given for insulating electric coils and spools with molten glass. The glass used for this purpose is made of PbO 223, SiO_2 30 to 35, B_2O_3 14 to 46, and KOH 14 to 38 parts by weight. If a Na glass is desired, Na_2CO_3 28 to 51 is substituted for the KOH.

Spun-glass products. BRITISH THOMSON-HOUSTON CO., LTD. Brit. 543,434, March 11, 1942 (Sept. 16, 1939). K. N. MATHES (General Electric Co.). U. S. 2,278,207, March 31, 1942 (Sept. 16, 1939).

Thin glass thread. FRITZ VIERTEL (Carl Hamel Akt.-Ges.). Ger. 706,987, May 8, 1941; 32*a*. 25; *Chem. Abs.*, **36,** 2102 (1942).—Fine glass thread on its way from the melting furnace to the winding spools is pulled over heated surfaces, e.g., of steel. The glass thread is heated by these hot surfaces to such an extent that it becomes plastic but does not melt. This enables the thread to be stretched still further without breaking.

Web and thread from continuous glass fiber. ARTHUR MANGER. Ger. 699,846, Nov. 7, 1940; 32*a*. 25; *Chem. Abs.*, **35,** 7137 (1941).—An apparatus for the production of the web and thread is described.

Structural Clay Products

Effect of freezing temperature in freezing-and-thawing tests of brick. JOSEPH C. RICHMOND AND JOHN W. MCBURNEY. *Proc. Amer. Soc. Testing Materials*, **41,** 967–74 (1941).—The effect of freezing and thawing for 50 cycles, using freezing temperatures of 20° and −20°F., on the resulting disintegration of two samples of half-brick is reported. The two samples were formed by breaking brick of a single sample into half-brick. The sample included a picked group of brick formed by the dry-press, soft-mud, and stiff-mud processes and was similar to samples tested in 1938 (*Ceram. Abs.*, **18** [5] 128 (1939)). R.A.H.

Immediate need for research in structural clay products industry. DOUGLAS F. STEVENS. *Bull. Amer. Ceram. Soc.*, **21** [4] 59–60 (1942).

Modern works in an old shell. ANON. *Claycraft*, **15** [5] 123–24 (1942); see *Ceram. Abs.*, **21** [4] 82 (1942). G.A.K.

Modular-unit planning. C. MOURITZ. *Building*, **16** [6] 138–40 (1941); *Bldg. Sci. Abs.*, **14** [10] 159 (1941).—M. outlines the modular-unit principle of planning, which is intended to facilitate the increased use and interchange of mass-produced, prefabricated parts and their economical application in building construction. Planning is done in multiples of a modular unit which would apply to the inside of the structure. The modules are either 3-in. or 4-in. units, subdivisions and multiples of the former being more adaptable to brick sizes and to precast concrete floor and roof construction units, while those of the latter meet the requirements of plywoods, hardboards, plasterboards, and other sheet materials in internal prefabricated work. The modular unit may also be applied in the vertical plane and to the design of houses of varying accommodation and type, the various structural members having modular-unit dimensions. The advantages of modular-unit planning in connection with postwar building problems are discussed.

Perforated clay block for bearing walls, DIN 4151. *Bauverwaltung*, **61** [14] Supp. pp. 255–58 (1941); *Bldg. Sci. Abs.*, **14** [8] 114 (1941).—The German specification for perforated clay blocks for load-bearing walls, DIN 4151, contains a definition of the blocks and states form, dimensions, and types. Distinction is made between blocks with transverse and those with longitudinal perforations, the former being perpendicular to and the latter parallel to the bearing surface. The required mean and minimum compressive strengths obtained by testing 10 specimens are, respectively, 100 and 80 kgm. per cm.^{2} for the blocks with transverse perforations and 60 and 50 kgm. per cm.^{2} for those with longitudinal perforations. The methods of testing compressive strength and water absorption are described. The principles for the construction of walls of perforated clay blocks corresponding to DIN 4151 are stated. The blocks may be used for the upper stories of buildings up to 5 stories high. For a 5-story building, the ground floor walls must be of full brick of a minimum compressive strength of 100 kgm. per cm.^{2}. The minimum thickness of loaded external and party walls is stated. For a 5-story building the required thickness is 30 cm. for the first and second stories and 25 cm. for the third and fourth. External walls less than 30 cm. thick may be built of perforated clay blocks only if the manufacturers hold a license from the building authorities in respect to the adequate heat insulation of such walls. External walls of blocks with transverse perforations 30 cm. thick (or less than 38 cm. thick) may, with respect to adequate heat insulation, be built without special permission only if the blocks are at least 10.4 cm. high and do not exceed the weights stated in the specification. Load-bearing walls 25 cm. thick or less are permitted only if adequately stiffened by transverse walls or if the height of the story does not exceed 3.3 m. For the erection of party walls with perforated clay brick it is necessary to have a license from the building authorities with reference to the sound-insulating properties. Fire walls must be at least 25 cm. thick. Cellar walls may, under certain conditions, be built of perforated clay blocks. Lime-cement mortar is to be used for perforated clay block masonry. The requirements for the compressive strength

of the masonry, mortar joints, external wall plaster, openings in the walls, etc., are stated.

Role of sulfates in the decay of building stones, mortars, and brick. THOMAS MCLACHLAN. *Jour. Soc. Chem. Ind.* [London], **59** [7] 133–38 (1940).—During the last few years attention has been concentrated on the action of sulfates as the major causative influence in the decay of building stones, mortars, and brick. In a previous paper (*Soc. Chem. Ind., Proc. Food Group*, **1**, 48 (1938)), McL. stated that the decay of these materials is largely a matter of soil microbiology and not a purely chemical and physical one. The sulfate content of various decaying building materials has been determined, and McL. contends that the amounts of sulfate present are insufficient to indicate that they play any major part in incipient decay. In certain instances, where efflorescences appear to affect disintegration, e.g., behind blisters, it seems probable that the salts may assist largely by increasing moisture movements and not necessarily by exerting pressure as the result of crystallization.

PATENTS

Brick machine mold trimmer. F. M. ANTIBUS, JR., AND H. D. CAYLOR (C. & G. Potts & Co.). U. S. 2,280,276, April 21, 1942 (June 21, 1940).

Brick-treating method and apparatus. G. B. KISSINGER. U. S. 2,277,764, March 31, 1942 (Nov. 2, 1936).—The method of treating ceramic or analogous material such as brick to obtain finished brick by means of a continuous 15-day treating process comprising the steps of stacking one fourth of the full charge in position to be treated, completely enclosing the partial charge with kiln sections, passing tempered waste gases from cooling kilns through the materials for approximately 24 hr., completely removing the kiln sections from the partial charge to allow free circulation of air through the partially dried material whereby the harmful gases are rapidly dissipated to permit the stacking of further green material, stacking a second one fourth of the full charge upon the first-mentioned one-fourth charge, completely enclosing the partial charges with the kiln sections and passing the tempered waste gases through the partial charge for approximately 24 hr., repeating the steps until the several one-fourth charges are partially dried and the last one fourth of the full charge has been subjected to the tempered gases for approximately 24 hrs., then passing untempered waste gases from a burning kiln through the material for 24 hr. to effect water-smoking and through the water-smoked material while firing the material for 24 hr. to preheat the charge, increasing the firing of the material for 72 hr. to effect firing of the charge, withdrawing the fire from the material and allowing 48 hr. to effect partial cooling of the charge while covered and without admission of external air, permitting ingress of external air to the covered material for a further 24 hr. to effect further cooling of the charge, completely removing the kiln sections from the material and permitting material to cool for 48 hr. in the open to complete the cooling, and removing the material to a storage room or to any other desired point.

Load-bearing acoustic building block. M. T. STRAIGHT. U. S. 2,281,121, April 28, 1942 (Aug. 25, 1939).

Refractories

Alumina from clay, etc. A. W. HIXON. *Amer. Metal Market*, **48** [214] 1, 7 (1941); abstracted in *Bull. Brit. Non-Ferrous Metals Research Assn.*, No. 151, p. 4 (Jan., 1942).—H. states that alumina may be extracted from clay by heating, treatment with HCl, treatment with a suitable selective organic solvent such as isopropyl ether to remove the ferric chloride, and concentrating and heating the residual aluminum chloride solution. Isopropyl ether is said to be available in practically unlimited amount as a by-product of the petroleum industry.

Change in quality of silica brick for coke ovens. A. KORA. *Jour. Fuel Soc. Japan*, **20**, 14–16A (1941); *Brit. Chem. & Phys. Abs.-B*, **I**, 451 (Oct., 1941).—Comparative tests on a new SiO_2 brick and on portions of a 10-yr.-old brick cut from the oven side, the center, and the combustion chamber side are tabulated. There was little change in refractoriness or deformability under load, but some tridymite was observed.

Dolomite and sea water used for making magnesia refractories. ANON. *Mining & Met.*, **23** [421] 17 (1942).—The operation of the Cape May plant of the Northwest Magnesite Co. is reviewed briefly. B.C.R.

Grog scrap for refractory products. ANON. *Keram. Rundschau*, **48** [31] 253–54 (1940).—The scarcity of grog scrap which many manufacturers of refractory materials are experiencing makes necessary the careful salvaging of broken fragments from the furnace and storage room. These should be sorted according to quality and whether acid or basic and stored ready for use. Some plants have been forced to manufacture what they need from clay which is not lean or from normal grog masses shaped into blocks so that they can be dried and fired in the furnace as regular block. The firing of scrap broken during drying and handling and methods of charging the furnace are discussed. M.V.C.

Manufacturing parts for tile ovens by casting. ANON. *Keram. Rundschau*, **48** [36] 299–300 (1940).—Practically all parts of tile ovens can be made by the casting process, although some parts, such as hoods, cornices, or parts with sharp edges, are more economically produced by hand molding; tile, however, can be made better on presses than in any other way. The casting process is becoming more widely used because of its cheapness and because it does not require skilled labor. The most important factor in the casting process is the preparation of the casting slip; the essential features of preparation of the slip and molds and the casting process are given. M.V.C.

Precast panel insulating refractories for industrial furnaces. HOWARD C. THAYER. *Heat Treating & Forging*, **28** [2] 92–93 (1942).—The advantages of panel construction are pointed out. S.S.

Principal physical tests for fire-clay refractories: V. R. S. BRADLEY. *Brick & Clay Record*, **97** [2] 47–48 (1940).—B. describes a method for determining the apparent porosity of fire-clay brick, using specimens $2^1/_4$ x $2^1/_2$ x $4^1/_2$, cut from standard brick. The water saturation (by boiling for 2 hr.) method is used. **VI.** *Ibid.*, [3] 55–56.—The procedure and equipment for determining cold crushing strength and the modulus of rupture of fire-clay brick are described. For Parts **III** and **IV** see *Ceram. Abs.*, **20** [11] 264 (1941). B.C.R.

Properties of the dry air-setting type of refractory bonding mortar. RAYMOND A. HEINDL AND WILLIAM L. PENDERGAST. *Jour. Research Nat. Bur. Standards*, **28** [4] 401–16 (1942); RP 1461. Price 15¢.—Seventeen air-setting refractory mortars (4 of which had a chromite base), marketed in the dry condition and furnished by 12 manufacturers, were subjected to a series of tests. Different amounts of water were added to the mortars to obtain consistencies suitable for preparing specimens of the neat mortar and for use in bonding brick by troweling and dipping methods. Six of the mortars were furnished in metal drums and the remainder in paper-lined jute sacks. They remained in storage for 1 week to 49 months before being tested. The water required for bringing the mortars to a troweling consistency ranged from 16.6 to 43%, and that required for a dipping consistency ranged from 20.7 to 60.1%. The ease of troweling on brick, determined mechanically, was considered satisfactory for all but 5 of the mortars. The workability of seven of the mortars was considered unsatisfactory when of a dipping consistency. The percentage flow (consistency), as determined with a flow table, ranged from 24 to 110, with 12 of the mortars ranging between 62 and 86. After slaking in water 1 hr., 16 of the 17 mortars showed less than 4% retained on a No. 40 U. S. standard sieve, and in no case was the residue on a No. 20 sieve greater than 0.5%. The free-alkali content, expressed as sodium oxide, ranged from 0 to 1.90%. The

P.C.E. of the mortars ranged from 20 to above 38, and there was very little difference between the end points of calcined and uncalcined materials. Eight of the mortars cracked seriously when mechanically troweled on brick and dried. The time required for the mortars to air-set, indicated by their resistance to flow under load, ranged from 1 to 30 min. when used to bond firebrick of 8.6% absorption. The average transverse dry strengths of the air-set neat mortars ranged from 250 to 4990 lb. per in.^{2}. With three exceptions, the strength of the test specimens was considerably greater when the surface uppermost during drying was in tension in the breaking test. Eleven of the mortars showed lower strengths after heating at 750°C. than after heating at 1000° or 1350°C., 4 being weakest after air-drying and 2 strongest. The bonding strength of the dried mortars in assemblages of 2 half-brick and mortar ranged from 45 to 480 lb. per in.^{2}. Brick specimens bonded with 11 of the 17 mortars were weaker after heating at 1000°C. than after drying or heating at 750°C. Furthermore, 7 of the mortars preheated at 1000°C. had practically no bonding strength. In these tests, failure of the assembly occurred in either the brick, the mortar, the joint, or some combination of these. Piers of 2 standard-size brick and 2 half-brick (making 2 horizontal joints and 1 vertical joint) were made up with $^1/_8$-in. and $^1/_{16}$-in. joints. The mortar joints of piers for 5 of these mortars, all of which had high drying shrinkages, were badly cracked after drying. As a result of heating at 1500°C., 8 of the mortars either had become fluid enough to bulge from the joints or had cracked. Some of the mortars shipped and stored in sacks, rather than in airtight containers, would undoubtedly have had better strength and bonding properties if they had been tested soon after manufacture. The mechanical troweling test is a much better measure of the workability of a mortar than the water-retention or time-of-set test. The failure of a cap of mortar to adhere to brick was no indication of its bonding properties. Much pertinent information relative to the quality of a mortar may be obtained from the fusion-block test. See *Ceram. Abs.*, **18** [11] 301 (1939); *Bull. Amer. Ceram. Soc.*, **19** [11] 430–34 (1940). R.A.H.

Refractories in wartime. DESMOND EYLES. *Chem. Age* [London], **46** [1184] 125 (1942).—Although chrome-magnesite refractories are more expensive, they are more durable and are therefore more economical. Large quantities of chrome-magnesite refractories are used for the walls and roofs of electrosteel furnaces. They are also used in the copper and cement industries, their outstanding qualities being resistance to slags and to sudden temperature changes. The main prewar sources of chrome ore were Greece, Turkey, and Cuba. Importation is now in the hands of the Control Department of the Ministry of Supply. The indifferent refractoriness of chromite brick under load is their weakest point and partly accounts for the trend toward chrome-magnesite brick. There are vast resources of raw materials for chrome refractories in several of the British dominions and colonies, particularly South-West Africa and Rhodesia. Ordinary dolomite was probably first used as a refractory material over sixty years ago and is still used on a large scale. The great disadvantage of dolomite brick is their reaction to air and water, and research in this field has perfected a water-resistant dolomite brick. This is now in use in about 90 British steelworks. Zircon and zirconia products seem to be making some progress in the U. S.; they are of particular interest to Great Britain because they are resistant to coal slag, a very important factor with regard to power stations. The largest zirconium deposits are in the British Empire. Graphite (plumbago) crucibles are important for melting brass, copper, aluminum, nickel, iron, steel, and precious metals. Suitable raw materials are found in Madagascar and Ceylon. Graphite and fire-clay crucibles are of particular importance in the aluminum industry in Great Britain. In Germany, both of these materials and also special barium aluminum silicate refractories are used. Since about 1912, Germany has been using refractory carbon brick made mainly from coke and tar. Before the war, they were also being used in Soviet Russia, Sweden, Belgium, and Italy for parts of blast-furnace linings which must withstand the highest temperatures. Carbon brick have a better resistance under load to high temperatures than best-quality fire-clay brick, and they do not react with blast-furnace slags or with the alloy constituents of pig iron. They can be made in quite large blocks, thus reducing the number of joints. The heat conductivity of carbon brick is 15 to 20 times that of fire-clay brick; this permits much more intensive cooling. In Great Britain and in the U. S., great interest has been shown in carbon blocks and brick; research work in this field is now even greater than that in Germany. Hot-face insulating brick are being used in Great Britain up to 1400° and in Germany up to 1500°C. Rapid strides have been made in the application of insulating firebrick; these brick can be used to back up a refractory wall and can be directly exposed to the flame in high-temperature furnaces. By the use of suitable insulating brick, a furnace can be brought up to the required temperature in less time, and heat losses through the walls and roof are prevented. Diatomaceous earth is used for temperatures up to 800°C.; it is imported from Ireland and Portugal. For higher temperatures, fire-clay and china-clay brick are mainly used. These are made porous by the introduction of sawdust which is burned out during the firing. In the United Kingdom, the wartime situation with regard to refractories is satisfactory. Prewar research had already ensured the best possible use of those refractory materials which are found within its boundaries, and sufficient imports of other materials are obtainable from other parts of the British Commonwealth or from the Allies. The superiority of British war weapons is due in no small measure to the progress already made in the refractories field, and the constant striving for still higher quality has led to important developments. See *Ceram. Abs.*, **21** [5] 102 (1942). A.B.S.

Silica brick and its inventor, William Weston Young. RHYS JENKINS. *Iron & Coal Trades Rev.*, **144** [3862] 213 (1942).—J. presents a historical review of fuels and hearthstones and refractory materials formerly used. Young first used Dinas rock with lime as binder in 1820; Dinas was practically pure silica. The average composition was silica 98.31 to 96.73, alumina 0.72 to 1.39, protoxide of iron 0.18 to 0.48, lime 0.22 to 0.19, potash and soda 0.14 to 0.20, and combined water 0.35 to 0.50. M.H.

Tests on alumina cement. ANON. *Chem. Age* [London], **46** [1181] 90 (1942).—Experiments were carried out, under factory conditions, with the new fused alumina cement "C" manufactured by the Thermal Syndicate, Ltd., Wallsend, Northumberland, England. The product is manufactured in two qualities, 40 and 60, the latter being used for the test. A heated element was prepared and suitably mounted. The cement was mixed with water, forming a thick paste, and was applied with a paintbrush until the element was completely encased. A low alternating current was applied to dry the cement, and the surface, when completed, proved to be quite hard. After use, when maximum heat had been obtained, the surface was found to be in good condition. The drying propensities of the cement are good. It is unaffected by heat, giving a good surface before and after test. The drying a. c. was very low, but for the purpose of testing, a 240-volt current was used for periods up to 20 hr. A.B.S.

PATENTS

Alumina-recovery process. R. W. BROWN (Aluminum Co. of America). U. S. 2,280,998, April 28, 1942 (April 13, 1940).

Cellular refractory. W. S. QUIGLEY AND J. G. COUTANT (Quigley Co., Inc.). U. S. 2,278,486, April 7, 1942 (Sept. 26, 1936).—A stable high-insulating refractory block, layer, or other product, composed of an expanded and set mixture containing a fine aggregate of the order of 150-mesh of indurated fire-clay particles and a hydraulic cement and being free of any coarse aggregate, the product having a structure containing relatively large gas-filled globular cells of visible size separated by relatively thin refractory walls, the thin separating walls being composed

of the fire-clay particles and cement and being highly porous by reason of the indurated fireclay particles containing minute voids of microscopic character, whereby to constitute an insulating product of very light weight adapted to withstand continued exposure to furnace temperatures.

Extraction of magnesium ions from sea water. Ocean Salts (Products), Ltd., and B. A. Adams. Brit. 543,665, March 18, 1942 (Dec. 20, 1940).

Formed goods of asbestos with refractory materials. F. S. Stepachev. Russ. 56,667, March 31, 1940.—The mixture is pressed, and the pressed goods are bent into the desired shape. A.A.B.

Forming brick. Victor Gross. Fr. 852,041, Jan. 22, 1940; *Chem. Abs.*, **36,** 2104 (1942).—Quartz rocks are fused by means of an electric furnace, and the molten mass is cast in appropriate molds.

Furnace construction. S. M. Jenkins (Armstrong Cork Co.). U. S. 2,277,984, March 31, 1942 (Sept. 26, 1939).

Furnace-wall construction. L. H. Hosbein (M. H. Detrick Co.). U. S. 2,279,515, April 14, 1942 (Oct. 18, 1939).

Furnace wall tie. A. K. Spalding (Thermo Fire Brick Co.). U. S. 2,279,644, April 14, 1942 (May 18, 1940).

Hollow tile. R. C. Benner and J. C. McMullen (Carborundum Co.). U. S. 2,277,507, March 24, 1942 (Dec. 16, 1938).

Magnesia refractory. H. H. Chesny. U. S. 2,281,477, April 28, 1942 (Sept. 15, 1937).—A dead-burned magnesium oxide clinker consisting of agglomerates of long and relatively thin particles.

Manufacture of basic refractories. H. C. Lee (Basic Refractories, Inc.). U. S. 2,278,454, April 7, 1942 (July 15, 1936).—A process of making refractories which comprises heating materials containing magnesia and lime and silica to silicate formation including calcium orthosilicate and merwinite providing a hydraulic low-temperature bond and a crystalline high-temperature bond with periclase.

Method of forming basic linings of furnaces. G. B. Crespi. U. S. 22,050, March 24, 1942 (June 21, 1941); reissue of U. S. 2,206,277 (*Ceram. Abs.*, **19** [9] 218 (1940)).—A method of forming a basic lining in a hearth or in other structural parts of a furnace which consists in applying finely ground pure calcined dolomite in cold condition in successive layers upon the inner face of the furnace to be treated, tamping the dolomite layers one after the other against the face by a suitable tool until a unified and compact lining is formed, and transforming the lining by action of heat during furnace operation into a petrified monobloc mass.

Method of molding refractory goods from nonplastic materials. G. O. Gross. Russ. 52,198, Nov. 30, 1937.—The molds are charged with the dry granular material, and the liquid is injected from above by placing the mold under vacuum. A.A.B.

Refractories. Dynamidon-Werk Engelhorn & Co. G.m.b.H. Ger. 706,163, April 10, 1941; 80*b*. 8.18; *Chem. Abs.*, **36,** 2105 (1942).—Refractory blocks are made from a calcined mixture containing CaO and SiO_2 in a molar ratio of 1.5 to 3:1. To this mixture is added H_3PO_4, H_3BO_3, Cr_2O_3 or ZrO_2 and MgO or Cr compounds. The calcining is preferably done in an electric arc furnace. The calcined product is formed into blocks and fired.

Refractories. Fritz Köberich. Ger. 705,569, March 27, 1941; 80*b*. 8.18; *Chem. Abs.*, **36,** 2105 (1942).—Refractory linings for rotary kilns are made of ground clinker, cement, water, and dead-burned CaO (to raise the fusion temperature). The mixture is formed and then calcined to just below the fusion point. The analysis of an appropriate starting material (ground clinker) is SiO_2, 13.3, Al_2O_3 3.4, Fe_2O_3 1.2, $MgCO_3$ 2.5, and $CaCO_3$ 79.6%.

Refractories. Österreichische Magnesit Akt.-Ges. Austrian 157,943, Feb. 10, 1940; 40*a*; *Chem. Abs.*, **36,** 2106 (1942). Addition to Austrian 150,288 (*Ceram. Abs.*, **17** [5] 189–90 (1938)).—A method is described for laying refractories without the use of mortar. Metal strips are used instead.

Refractory. C. J. Kinzie and Eugene Wainer (Titanium Alloy Mfg. Co.). U. S. 2,277,704, March 31, 1942 (March 31, 1939).—A refractory composition comprising a refractory base and a minor quantity of a material capable of a substantial and uniform expansion at a high temperature as the result of chemical change, the material being taken from the class consisting of thermal reaction products of zirconium and carbon, titanium and carbon, thorium and carbon, cerium and carbon, hafnium and carbon, silicon and carbon, zirconium and nitrogen, titanium and nitrogen, thorium and nitrogen, cerium and nitrogen, hafnium and nitrogen, and silicon and nitrogen, the material being in finely divided form and uniformly distributed throughout the base, the amount of the material being predetermined to control the expansion and contraction characteristics of the refractory composition.

Refractory and abrasive material and process of making. R. C. Benner, H. N. Baumann, Jr., and G. J. Easter (Carborundum Co.). U. S. 2,279,260, April 7, 1942 (March 21, 1939).—A cast refractory article consisting principally of trigonal crystals of a solid solution of alumina and chromic oxide, the chromic oxide being at least 8% and the alumina and chromic oxide together being at least 80% of the weight of the article, the article also comprising 2 to 6 FeO, 1 to 6 MgO, and 2 to 7% acid oxides, the acid oxides being present in amount sufficient to materially inhibit the formation of spinel crystals within the article.

Refractory brick. W. H. Henson and K. H. Bird (Norton Co.). U. S. 2,281,003, April 28, 1942 (Aug. 24, 1940).

Refractory brickwork. W. R. McLain. U. S. 2,281,-200, April 28, 1942 (Aug. 10, 1939).

Refractory composition. Eugene Wainer and H. D. Prior (Titanium Alloy Mfg. Co.). U. S. 2,277,735, March 31, 1942 (Dec. 2, 1940).—A composition suitable for forming refractory masses comprising zircon, 0.010 to 0.014 sodium silicofluoride, 0.4 to 0.6 calcium zirconium silicate, 0.007 to 0.009 oxalic acid, 0.015 to 0.019 tetrasodium pyrophosphate, 0.015 to 0.019 Portland cement, and 1.7 to 2.3 parts of silica per 100 parts of zircon.

Refractory composition and method of making. C. J. Kinzie and Eugene Wainer (Titanium Alloy Mfg. Co.). U. S. 2,277,705, March 31, 1942 (Jan. 25, 1940).—A fluid moldable composition suitable for forming refractory articles comprising a major proportion of zircon and water in an amount not substantially more than 17 cc. per 100 gm. of zircon, the composition containing less than 0.01 gm. per 100 cc. of water of dissolved calcium and aluminum salts.

Refractory crucible. Walter Eichholz (August Thyssen Hütte Akt.-Ges.). Ger. 705,468, March 20, 1941; 18*b*. 21.03; *Chem. Abs.*, **36,** 2106 (1942).—A crucible of over 1-ton capacity, for coreless induction furnaces, has an inner basic lining (dolomite, magnesite, etc.), and between the inner lining and the water-cooled coil is put a refractory material of the nature of sillimanite.

Terra Cotta

Brown ware as fireproof cooking utensils. Joseph Grewe. *Keram. Rundschau*, **48** [29] 238–41 (1940).—The demand for fireproof cooking utensils for use on an open flame is increasing, not only because of the shortage of iron for enameled ware and of aluminum but also because food cooked in this ware has a better flavor and appearance. With ordinary usage this ware may last 10 years. A mix for a high-grade product contains $1^1/_2$ parts fine-grained Sandersleben raw kaolin, 2 parts Altenburg refractory clay, $1^1/_2$ parts Hallesch lean clay, and 1 part pitchstone. Raw materials containing quartz are generally unsuitable. The preparation and working of the mix are especially important, and the raw materials should be tested regularly. Directions for grinding, sifting, drying,

glazing, and firing are given. Suitable mills and furnaces and their operation are described. Illustrated. M.V.C.

Firing wall tile in tunnel kilns without saggers. JOSEPH GREWE. *Keram. Rundschau*, **48** [40] 328–30 (1940).—The biscuit firing of wall tile without saggers requires slower preheating and cooling, a uniform temperature curve, and careful regulation of the draft. Diagrams show how thin tile should be stacked on the cars to insure best results. M.V.C.

Progress in the field of chemical equipment: III, Transportation of liquids; IV, Transportation of gases. BRUNO WAESER. *Chem. Fabrik*, **12** [17–18] 218–21; [19–20] 241–43 (1939); for Parts **I, II,** and **V** see *Ceram. Abs.*, **21** [3] 65 (1942). J.M.N.

Tile stoves with hot-water heating system. RUDOLF LUNGHARD. *Keram. Rundschau*, **48** [25] 205–207 (1940).—L. describes an improved tile stove which heats quickly, holds the heat, and gives an even heat with good circulation of air. It is light colored and easily cleaned and is an ornament to the home because of its well-proportioned form and tastefully glazed and decorated exterior. The hot-water heating plant comprises the tile stove with a boiler and porcelain radiators, both of which represent a saving in metal. The construction of the stove and radiators is illustrated. See "Artistic . . . ," *Ceram. Abs.*, **20** [11] 256 (1941). M.V.C.

PATENT

Ceramic valve. G. V. SAFONOV. Russ. 52,630, Feb. 28, 1938.—Construction details of a ceramic valve are given. A.A.B.

Whiteware

Ceramic casting slips. F. R. *Keram. Rundschau*, **48** [28] 229–32 (1940).—British, U. S., and German patents dealing with liquefacients, suspension agents, pH, drying accelerators, stiffening agents, etc., for improving casting slips used in the manufacture of porcelain and many other types of ceramic ware are described. The manufacture of ware by casting is a simpler and easier process than the working of plastic bodies and makes mass production possible. M.V.C.

Ceramic filters. LAKAFF. *Keram. Rundschau*, **48** [33] 269–71 (1940).—Ceramic filters possess not only the sifting and screening action of other filters but also an adsorptive action which makes them suitable for filtering bacteria and degerminating gases and liquids. Besides the glazed porous filters made of stoneware or porcelain, ceramic filters may be produced from porous clay and other fine-grained materials or with the addition of agents to augment porosity. They have a high mechanical strength, are resistant to high temperatures, acids, bases, and alkalis, and are easily cleaned; their low elasticity is being corrected in some cases. The form of the filter varies with the shape of the filtering apparatus and may be a plate, cylinder, or nozzle. The average porosity of ceramic filters is 40 to 50%; the size of the pores varies between 48 and 0.2 μ. The porosity figure is between 100 and 400 million per sq. cm. The filtering power is characterized by the rate at which the liquid passes through the filter and depends on the size of the pores, the thickness and surface area of the filter, and the pressure. The oldest types of filter are the fine-grained clay and porcelain filters first used by Pasteur for filtering bacteria. They are also used for sterilizing, in the production of wine, beer, and fruit juices, and for purifying in chemistry. They are manufactured from finely ground clay, kaolin, feldspar, and calcite with the addition of agents to increase porosity. Fritted filters without bond for industrial uses are made of granular grog, quartz, graphite, corundum, or porcelain molded under pressure and fired to 800° to 1300°C. Laboratory filters are usually made from sintered granulated porcelain or glass. Granular filters with a bond such as clay, kaolin, glass, or organic material are also made on presses. Kieselguhr filters made with 10% kaolin are excellent for sterilization. Filters are also used for distributing gases in liquids as in the transportation of live fish, as water purifiers, as foam producers in the flotation of minerals, as liquefacients in silos, for diaphragms between the cathode and anode in electrochemical processes, and, recently, in surface reactions and radiation regulation. M.V.C.

Decorating porcelain without gold. W. FUNK. *Keram. Rundschau*, **48** [34] 277–79 (1940).—Valuable porcelain objects can be made without the use of gold decoration. Unpainted porcelain fills many purposes, but the attractiveness is heightened by an appropriate relief decoration, alone or in combination with a few lines of a bright color, such as fiery red. F. discusses the relative merits of decorating porcelain with sharp-fire colors, either underglaze or overglaze, or muffle colors and the special method employing transparent or translucid relief or "applied" colors (Collected Writings of Hermann A. Seger, Berlin, 1908, p. 579 *et seq.*) or combinations of these colors. M.V.C.

Discussion of "Ceramic insulations for high-frequency work." G. P. BRITTON. *Jour. Inst. Elec. Engrs.* [London], **88,** 172–74 (1941).—B. amplifies Robinson's brief survey of manufacturing methods (*Ceram. Abs.*, **20** [9] 219 (1941)), stating that dry-pressing, although more costly, is superior to wet-pressing. The former requires dies with many moving parts, automatic presses, and a special mix; the latter uses oils and/or water to plasticize the powder. Another method using extruded or pressed blanks which are machined is advantageous in that a few of one design can be made and modifications can be tried before the final method is adopted. Tolerances of ±0.001 in. for parallel grinding of fired insulators and, in one case, of ±0.00025 in. for cylindrical grinding are undertaken commercially when gauging becomes difficult. L.R.B.

Drying porcelain bodies. ANON. *Keram. Rundschau*, **48** [29] 241–42; [30] 247–48; [31] 256–58 (1940).—The physical processes involved in eliminating the 20 to 25% moisture content of molded porcelain bodies before firing are reviewed. The moisture content of the drying air at different temperatures and pressures and the absorption capacity of the air with varying moisture content, temperature, and pressure are calculated. Instruments for measuring the moisture content of the air are described, together with the construction and operation of modern drying installations in which the temperature, moisture content, velocity, and water-absorption capacity of the air as well as the uniform evaporation of water from the inside of the bodies are carefully controlled. The differences between the properties of porcelain bodies dried in air and those of bodies dried artificially in driers have not been investigated thoroughly. M.V.C.

High-voltage porcelain insulators. J. S. FORREST. Presented at meeting of Inst. of Electrical Engineers, London, Nov., 1941; abstracted in *Electrician*, **127** [3313] 306–307 (1941); see "Insulators," *Ceram. Abs.*, **19** [8] 193 (1940). H.K.R.

Impulse characteristics of porcelain insulators. G. W. BOWDLER AND W. G. STANDRING. *Jour. Inst. Elec. Engrs.* [London], **88** [5] 443–52 (1941).—The following subjects are discussed: (1) flashover voltage of insulators and gaps subjected to impulse voltages of different wave shapes; (2) relation of crest voltage and time to flashover at voltages above the minimum required for flashover; (3) breakdown while the voltage is rising rapidly; (4) simultaneous application of impulse and alternating voltages; and (5) the proposed I.E.C. overvoltage test on insulator units. See "Performance . . . ," *Ceram. Abs.*, **20** [9] 214 (1941). L.R.B.

Labor shortage—higher demands for ceramic ware. ANON. *Keram. Rundschau*, **48** [26] 213–15 (1940).—Working methods will have to be simplified and several operations combined in ceramic plants because of the reduced labor force. By slight changes in batch formulas for glazes to lower or raise the fusing point, pieces that were formerly fired separately can now be fired in one operation. Batch

formulas for glazes and frits for staple ware and higher-grade ware which can be fired simultaneously are given together with directions for charging. M.V.C.

Low-temperature vitreous bodies. C. J. KOENIG. *Jour. Amer. Ceram. Soc.*, **25** [9] 230–36 (May, 1942).—7 references, 10 figures.

Problems of pottery manufacturing. ANON. *Engineer*, **172** [4485] 450–52 (1941).—Aspects of the industry in which the science of engineering holds the key to further progress are dealt with. The first magnetic separators used to remove objectionable iron were of such low intensity that they were incapable of removing any but the larger particles. Developments in electromagnetism have produced high-intensity separators. One successful type contains a series of magnet bars, each a separate casting, powered from enclosed magnet units. Each bar impedes the flow of the slip by its staggered projections. In the case of current failure, magnetically operated collapsible bridges divert the slip so that it does not mix with that already treated. A new principle in magneting is the supersession of projections and serrations by detachable box frames containing numerous pieces of perforated metal. These are fitted over each magnet bar and between each pair of magnets. The bottom of the trough thus forms a magnet grid through which the liquid must percolate. In glazed-tile manufacture the dust-pressing process is used; this might be found practicable for the production of china. Electric tunnel kilns have contributed considerably to the recent progress in pottery. G.A.K.

Sanitary porcelain. E. THRYSIN. *Tek. Tid.*, **70**, 341–46 (1940); *Brit. Chem. & Phys. Abs.-B*, **I**, 227 (June, 1941).—The development of vitreous sanitary porcelain is reviewed, and a specification for material for hospital use is proposed. Vitreous porcelain should not be cleaned with abrasive powders containing SiO_2; hot aqueous (Na) metasilicate, PO_3', or PO_4''' is recommended.

PATENTS

Bushing. L. J. STEVENS (Locke Insulator Corp.). U. S. 22,079, April 21, 1942 (Aug. 29, 1941); reissue of original U. S. 2,230,194, Jan. 28, 1941 (Sept. 6, 1939).

Bushing insulator. T. F. BRANDT (Ohio Brass Co.). U. S. 2,280,032, April 14, 1942 (Dec. 30, 1939).

Ceramic bodies. HERMANN HÖPPLI (Steatit-Magnesia Akt.-Ges.). Ger. 705,568, March 27, 1941; 80*b*. 8.08; *Chem. Abs.*, **36**, 2105 (1942).—$MgSiO_4 \cdot nH_2O$ (preferably pure) is ground and mixed with 10 to 15% of $BaCO_3$. The mixture is calcined at 1400° to 1500° for several hours and allowed to disintegrate by being kept damp for several days. The soft mass is then ground again, and in this state it becomes a valuable ceramic raw material. Its cone is 1550°.

Ceramic insulators. PHILIPS LAMPS, LTD. (N. V. Philips' Gloeilampenfabrieken). Brit. 543,568, March 18, 1942 (May 16, 1940).

Dielectric material and method of making. EUGENE WAINER AND N. R. THIELKE (Titanium Alloy Mfg. Co.). U. S. 2,277,733, March 31, 1942 (April 27, 1939).—In the method of preparing a fired ceramic dielectric material, the steps which comprise mechanically purifying naturally occurring rutile, incorporating the purified rutile into a body containing less than 1% total oxides of iron, copper, alkali metals, manganese, vanadium, cobalt, and nickel, less than 0.1% P_2O_5, less than 3% alumina, and less than 5% total silica and zirconium silicate, and then firing the body to form a ceramic mass. **U. S. 2,277,734**, March 31, 1942 (July 4, 1939).—The method of forming a ceramic dielectric material comprising firing at an elevated temperature a composition containing 80 to 97% of titanium dioxide and 3 to 20% of a preformed material taken from the class consisting of calcium, strontium, barium, cadmium, zinc, and divalent lead titanates. **U. S. 2,277,736**, March 31, 1942 (July 4, 1939; Feb. 3, 1941).—The method of forming a ceramic dielectric material comprising firing at an elevated temperature a composition containing 80 to 97% of titanium dioxide and 3 to 20% of boron titanate.

Insulator and method of producing conducting coating thereon. S. L. SANTOMIERI (Victor Insulators, Inc.). U. S. 2,281,173, April 28, 1942 (Jan. 10, 1940).—A high tension electric porcelain insulator having a fired surface conducting coating consisting of a material derived by firing a coated composition containing an inorganic compound of an element of group II of the periodic table and an inorganic compound of an element from the section of group VIII of the periodic table which contains iron, cobalt, and nickel.

Multipost line insulator. E. M. MEYER (Porcelain Products, Inc.). U. S. 2,278,330, March 31, 1942 (Aug. 4, 1939).

Nonchipping ceramic bodies. WERNER RATH (Porzellanfabrik Kahla). Ger. 705,303, March 20, 1941; 80*b*. 11; *Chem. Abs.*, **36**, 2105 (1942).—A mixture of ZrO_2 (55 to 90%) and MgO with slight admixture of Al_2O_3 and SiO_2 fired at 1400° to 1500° (Seger cone 14 to 18) is used for making tools for working synthetic materials and light metals, wire-drawing dies, mill linings, etc.

Spark plug. T. G. MCDOUGAL (General Motors Corp.). U. S. 2,280,962, April 28, 1942 (July 24, 1940). GEORGE PARKIN. U. S. 2,281,511, April 28, 1942 (July 1, 1940).

Spark plugs. EMIL KLINGLER, EMIL SCHÖNHERR, HEINZ SCHMIDT, AND FRIEDRICH GANTZHORN (Robert Bosch G.m.b.H.). Ger. 705,679, March 27, 1940; 80*b*. 8.03; *Chem. Abs.*, **36**, 2106 (1942).—Spark plugs are made from a mixture of twice-fused finely ground Al_2O_3 (Fe not over 0.05%) 75, calcined kaolin 17 (or calcined 11, uncalcined 6), purest quartz flour 3, and alkaline-earth oxides 5%. The spark plug can be dry-pressed, wet-pressed, or sprayed and is fired at not over 1650°. The glaze on the spark plug is made of feldspar not less than 60% and pure kaolin and (or) quartz flour and Al_2O_3. The feldspar contains up to 7% of alkali oxides.

Equipment and Apparatus

Automatic machinery lowers costs in newly patented batch house. ANON. *Ceram. Ind.*, **38** [2] 80, 82 (1942).—A description of U. S. Pat. 2,252,589 ("Glassmaking," *Ceram. Abs.*, **20** [10] 237 (1941)) is given. Illustrated. H.T.

Discussion of "Measuring surface area in grinding." P. S. ROLLER AND R. SCHUHMANN, JR. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1412; *Mining Tech.*, **5** [6] 1–2 (1941). **Reply.** F. C. BOND. *Ibid.*, pp. 2–3. See *Ceram. Abs.*, **20** [11] 268 (1941).

Filter presses without cloth. HANS LEHMANN. *Keram. Rundschau*, **48** [34] 279–84 (1940).—A filtering medium of nonceramic material, Flexolith, which combines the best features of textile, metal, and ceramic filters and has given superior service in the laboratory and in industry is discussed. Filters of this material can be made larger and thicker than ceramic filters, and they have a good elasticity and resistance. Illustrated. See "Filtration . . . ," *Ceram. Abs.*, **18** [10] 275 (1939). M.V.C.

Grinding in the ceramic industry. G. JUNCK. *Soc. Chem. Ind. Victoria, Proc.*, **40**, 292–96 (1940); *Brit. Chem. & Phys. Abs.-B*, **I**, 451 (Oct., 1941).—Dry-pan and ball-mill grinding are described briefly.

Hot-floor drier. ANON. *Brick & Clay Record*, **99** [6] 45–49 (1941).—By the use of ceiling and wall heaters, drying can be accomplished faster than by the usual steam-heated floors. The plant layout and products of the Ironton Fire Brick Co. are described and illustrated. B.C.R.

Intercomparison of platinum resistance thermometers between −190° and 445°C. HAROLD J. HOGE AND FERDINAND G. BRICKWEDDE. *Jour. Research Nat. Bur. Standards*, **28** [2] 217–40 (1942); RP 1454. Price 10¢.—Eight platinum resistance thermometers satisfying the requirements of the International Temperature Scale were calibrated on the International Scale and intercompared from −190° to 445°C. Differences between the readings of the platinum resistance thermometers arising from as-

sumed calibration errors at the fixed points were calculated and are given in a table. R.A.H.

Longer service from plaster molds by improved mold-shop practice. HAROLD T. HOMAN. *Ceram. Ind.*, **38** [3] 64, 66 (1942).—For efficient mold service, the design of the block mold, careful mixing of the plaster, and even wall thicknesses are important. Illustrated. H.T.

Maximum capacity, minimum labor with engineered conveyer system. W. R. SCHLEHR. *Ceram. Ind.*, **38** [2] 66–72 (1942).—At the Carr-Lowrey Glass Co., Baltimore, Md., a flexible powered conveyer system for warehouse distribution of ware frees much floor space, requires little labor, operates at minimum cost, and uses standard equipment. Illustrated. H.T.

Measuring workability of clay bodies. EDWARD C. HENRY. *Ceram. Ind.*, **38** [3] 72–74 (1942).—The Endell-Henry apparatus for measuring the workability of plastic clays and bodies is described. The principle of the apparatus consists in twisting the plastic test specimen under load until cracks occur. Illustrated. See *Jour. Amer. Ceram. Soc.*, **24** [9] 281–85 (1941). H.T.

Notes on drying. W. D. SEYMOUR. *Ind. Heating Engr.*, **3**, 79–81 (1941).—The rate of drying of a moist object in an air stream depends on the chemical and physical properties of the material and the drying power of the air. The latter is a function of the amount by which the vapor pressure of water at the material exceeds that in the air stream, the speed of the air, and the type of flow (turbulent or quiet). The higher the temperature, the greater is the drying power. The humidity may be measured by wet-bulb and dry-bulb thermometers. The air velocity, if high, can be measured by the vane anemometer down to about 50 ft. per min. Below this speed, it may be measured by means of the katathermometer. S. describes this instrument and gives tables by means of which the air speed can be evaluated. L.R.B.

Piezo quartz. ALFRED W. G. WILSON. *Can. Chem. & Process Industries*, **26** [1] 10–14 (1942).—W. gives a brief history and the principles and applications of the piezo-electric effect and lists specifications of good-quality crystals. Their geologic origin is uncertain; they usually occur with pegmatites. The principal source is Brazil, but some Canadian deposits are known. B.L.

Refractometers employing diamond and other minerals. B. W. ANDERSON AND J. PIKE. *Mineralog. Mag.*, **25** [170] 579–83 (1940).—The upper limit of refractive index which can be measured by direct-reading refractometers is restricted both by the medium employed for the prism (usually heavy lead glass) and by the liquid making optical contact between the specimen and the prism. The liquids available with refractive indices above 1.81 have disadvantages, one being that the glass of the prism is attacked. By replacing the glass with a prism of zinc blende or diamond, which possess high refractive indices and are not attacked by, e.g., West's liquid with a refractive index of 2.06, a greater range is given to the instrument. Such a refractometer is illustrated. The advantage of synthetic spinel over glass is discussed; it possesses a low dispersion, so that monochromatic light is not necessary. Neither diamond nor spinel is scratched by gem stones. L.R.B.

Statistical theory of the effect of dimensions and of method of loading upon the modulus of rupture of beams. JOHN TUCKER, JR. *Proc. Amer. Soc. Testing Materials*, **41**, 1072–94 (1941).—There is an inherent difference in the strength of duplicate test specimens, no matter how carefully these specimens are made and tested. Such differences are a natural characteristic of the materials and are more pronounced in some cases than in others. T. shows how the variations in strength of small elements of volume within a specimen will affect the modulus of rupture of beams of different dimensions and beams subjected to different loadings; e.g., the modulus of rupture of a beam is decreased with beam length and with beam depth and is greater in centrally loaded beams than in similar beams loaded at third points. R.A.H.

Welding of dies. HOWARD H. MANSUR. *Brick & Clay Record*, **97** [2] 23–25 (1940).—Dies other than those of standard shape and size can be made more economically by welding than by casting. Such fabricated dies are stronger and lighter and can be partially balanced during construction by the addition of tapered sections or chokes. B.C.R.

PATENTS

Apparatus for molding brick, blocks, and tile. R. S. SINK. U. S. 2,277,789, March 31, 1942 (May 3, 1939).

Apparatus for partially drying moist clay bodies. L. J. DYKSTRA AND E. M. MEYER (Victor Insulators, Inc.). U. S. 2,281,184, April 28, 1942 (Nov. 5, 1940).

Machine for continuous cleaning of clay. OTTOMAR ERFURTH (Eisen- und Hartgusswerk Concordia G.m.b.H.). Ger. 680,356, Aug. 3, 1939; 80*a*. 4.01; *Chem. Abs.*, **36**, 2104 (1942).

Method and apparatus for treating granular materials. C. L. COLBERT (Fiske Brick & Granule Co.). U. S. 2,277,073, March 24, 1942 (April 3, 1937).

Kilns, Furnaces, Fuels, and Combustion

Ceramic kilns. Present stage of development and probable future developments. A. MÖSER. *Feuerungstechnik*, **28** [9] 204–208 (1940); *Brit. Chem. & Phys. Abs.–B*, **I**, 405 (Sept., 1941).

Commercial firing survey of car-tunnel kilns. MCDONALD S. NELSON AND HEWITT WILSON. *Jour. Amer. Ceram. Soc.*, **25** [9] 237–40 (May, 1942).—2 references, 3 figures.

Electric resistance hearths. Developments in alloys for use as elements. ANON. *Electrician*, **128** [3328] 200–202 (1942).—Data on the nickel-chromium-iron alloys and some foreign variations in their application to the resistance heating of salt baths, drying ovens, and tunnel kilns for firing porcelain electrical resistors are given. The electric kiln has reduced the firing time of glazed porcelain ware from 240 hr. to 30 hr. The recirculation of warm air to reduce current consumption is mentioned. When firing at 800°C., the current used is about $^1/_2$ that used without air recirculation. H.K.R.

Electrostatic preparation of coal dust. F. L. KÜHLWEIN. *Glückauf*, **77**, 69–80 (1941); *Brit. Chem. & Phys. Abs.–B*, **I**, 384 (Sept., 1941).—An apparatus developed by Lurgi Apparatebau for the electrostatic separation of dirt from coal dust is described. Experiments showed that the ash content of bituminous coal dusts could be reduced from 10 to 15% to 3 to 4% and the total S content to 1%. The separated coal is rich in vitrain and clarain and thus has improved coking properties, while the rejected dirt is rich in pyrites. By treatment in stages, coal dust containing 1 to 1.5% ash can be obtained. The electrostatic cleaning process cannot be applied to anthracite; brown coals are less amenable to treatment than bituminous coals, owing to their high clay content.

Electrostatic preparation of fine coal and production of coal and coke with low or extremely low ash content. H. NIGGEMANN. *Glückauf*, **77**, 80–88 (1941); *Brit. Chem. & Phys. Abs.–B*, **I**, 384 (Sept., 1941).—Szantho's method for electrostatically separating dirt from coal dust is diagrammatically described. Application of the electrostatic cleaning process to low-grade coal dusts results in the production of coals of low ash content and improved coking properties.

Flow of gases in natural-draft furnaces. E. J. GOODING AND M. W. THRING. *Jour. Soc. Glass Tech.*, **25** [107] 21–85T (1941).—A comprehensive treatment of the flow of gases in a furnace is given. The first part deals with a method of measuring the values of aerodynamic resistances and buoyancies in a glass tank furnace system, and the second part deals with methods of measuring the distribution of flow within the regenerator. An appendix covers

the following topics: (1) the quantities of gas and air entering a glass furnace, (2) the use of thermocouples in the measurement of gas temperature, and (3) the principles of temperature measurement in regenerators and uptakes. The experimental data, comprising static pressures, temperature determinations, differential pressures, and gas velocities, are portrayed graphically and diagrammatically. The resistance to flow through the regenerator is negligible. A current of air and gas is drawn or driven by the buoyancy force of the incoming regenerator and the stack, minus that in the outgoing regenerator, against the resistances of the valves and the ports. In the case of a cold furnace, the air travels close to the base of the regenerator before it passes upward; a packing effect takes place farthest from the inlet. In the case of a hot furnace, the buoyancy effect is the primary influence on flow; momentum and regenerator resistances are negligible. The hot gases tend to rise near the inlet end of the regenerator. R.H.B.

Rapid method for ultimate coal analysis. R. BELCHER AND C. E. SPOONER. *S. African Mining & Eng. Jour.*, Oct. 25, 1941; abstracted in *Chem. Trade Jour.*, **110** [2850] 16–17 (1942).—A new method based on the high-temperature method of Vita (1920) for the analysis of sulfur in coal has been worked out for the ultimate analysis of coal; 0.5 gm. of coal is burned in a rapid stream of O_2 at 1350°C., the sulfur oxides and chlorine being absorbed on a 2-in. silver spiral at 800°C. in a cool part of the same reaction tube. H_2O is absorbed in magnesium perchlorate and CO_2 in soda asbestos. The silver is removed in hot water and the silver chloride in ammonia, giving direct readings of sulfur and chlorine. The apparatus and reagents required and the operations are described in detail. L.R.B.

Rumanian natural gas and its use in ceramics. LUTZ BENDA. *Sprechsaal*, **74** [10] 101–103 (1941).—Gas (mostly producer gas) is used as a fuel almost as much as wood or coal. Many ceramic industries have been attracted to Rumania including plants for making glass, tile stoves, refractories, porcelain, and, more recently, whiteware and sanitary ware. There is only one large tunnel kiln 82 m. long. The burners are low-pressure burners similar to those used with generator gas. In round kilns, it is more advantageous to use higher gas pressure, because this gives a much longer flame which makes possible a more uniform temperature. In an installation of two kilns, each having 12 burners, the most advantageous gas pressure was 45 mm. water column. These kilns were originally built according to plans that had proved satisfactory for illuminating gas, but it was found necessary, after three trial firings, to supply $2^1/_2$ times as much air. It is just as important to design a kiln for the fuel to be used as to design it for the type of ware to be fired. W.H.H.

Tunnel-kiln firing of soft-mud brick. ANON. *Brick & Clay Record*, **99** [6] 19–21 (1941).—Using a high-shrinkage clay, scove-kiln firing produced only about 90% salable brick compared with 99% for an oil-fired tunnel kiln. By means of a mechanical fork handling 1500 brick at a time (half of a kiln-car load), 190,000 brick may be loaded in trucks or cars by three men. B.C.R.

Uniform firing in potters' kilns. JOSEPH GREWE. *Keram. Rundschau*, **48** [26] 215–16 (1940).—The sloping grate in furnaces for firing pottery, in combination with two separately spaced perforated screening walls to distribute the combustion gases evenly through the furnace and to prevent flames or cool air from coming directly in contact with the charge, permits proper control of the draft and yields a saving in fuel and firing time. The grate must be inclined at an angle suitable for the fuel used, and the draft must not be too strong or irregular. Diagrams show the structure of fire grates and screening walls. The inclined grate is a great improvement over the level grate. M.V.C.

BOOK

Specific Heat, Enthalpy, Entropy, and Dissociation of Technical Gases (Spezifische Wärme, Enthalpie, Entropie, und Dissoziation Technischer Gase). E. JUSTI. Julius Springer, Berlin, 1938. 158 pp. Price Rm. 18 unbound, Rm. 19.80 bound. Reviewed in *Gas Jour.*, **224**, 837 (1938).—Recent developments in atomic physics make it possible to calculate the thermal characteristics of gases from their spectra. These calculations are amply substantiated by a few careful experimental values, so that it is now possible to make full use of the calculated values. J. explains the method of calculation, discusses a large number of gases individually, and gives comprehensive tables of specific heats, entropies, and enthalpies (total heats) of all the gases over the range 0° to 3000°C. The effect of pressure and the corrections to be applied are also considered. L.R.B.

PATENTS

Electric heating resistances. BRITISH THOMSON-HOUSTON CO., LTD. Brit. 533,193, Feb. 7, 1941 (Oct. 19, 1938); *Chem. Abs.*, **36**, 1860 (1942).—A steatite-Mg mixture is introduced into the sheath or casing wherein it is to be used and heated to 1000° to 1100° so as to decompose the H_2O *in situ*. The H becomes detached, and the mixture swells and hardens in the space. Suitable proportions of reactants are steatite 92.4, Mg 5.6, and KNO_3 2%.

Heating elements. METALLWERK PLANSEE G.M.B.H. Austrian 157,232, Oct. 10, 1939; 40*c*; *Chem. Abs.*, **36**, 1855 (1942).—The heating element is made of Mo, Ta, or W. The element is sheathed by a ceramic tube extending beyond the end of the resistor. Into this extension fits a good conductor such as Cu, Ni, Ag, or an Fe-Ni-Co alloy. A ceramic sealing cap which overlaps the end of the ceramic sheath fits over the end of the conductor. The metals and the diameters of the metallic conductor are so chosen that in operation they are of a plastic consistency.

Heating elements of high-melting metals. RADIO CORP. OF AMERICA. Ger. 705,766, April 3, 1941; 21*g*. 13.04; *Chem. Abs.*, **36**, 1855 (1942).—A heating element for indirectly heated cathodes is made of a high-melting ductile metal such as W. A thin wire of this metal is coated with a suspension of Al_2O_3 (maximum impurities 0.5%) in an organic binder, e.g., nitrocellulose. The coated wire is then heated at approximately 1800° in an atmosphere of H containing considerable H_2O vapor. This last condition is attained by passing the H through water kept at 50° to 55°. The wire is wound on a core made from a mixture of pure Al_2O_3 and flour paste and fired at approximately 1800° in an atmosphere of H containing water vapor.

High-temperature heating unit and method of making. REINHOLD REICHMANN (Westinghouse Electric & Mfg. Co.). U. S. 2,280,977, April 28, 1942 (April 30, 1940).—A high-temperature heating unit comprising a tubular ceramic body of cylindrical form, a helical groove on the outside of the body, a helical nonmetallic refractory closure closing the groove, the closure substantially matching the groove, a high-temperature metallic refractory heating element swelled in the groove through heating at high temperatures, and a snug-fitting gas-tight nonmetallic refractory outer cover around the body and closure.

Geology

Bentonite. LAKAFF. *Keram. Rundschau*, **48** [40] 327–28 (1940).—The properties and uses of bentonite are summarized. M.V.C.

Ceramic materials. ANON. *Ceram. Ind.*, **38** [1] 35–150 (1942).—This issue is practically entirely devoted to data on all ceramic raw materials, commercial specifications and tests, and typical batch formulas. It is the second edition of the October, 1940, issue. New materials have been added, and the section on commercial specifications and tests of ceramic materials is new. Interesting data on the consumption of ceramic materials and current prices are also given. This edition is a welcome reference book for the practical man as well as for the scientific ceramist. See *Ceram. Abs.*, **20** [6] 158 (1941). H.T.

Colloidal gold as a coloring principle in minerals. J. NEWTON FRIEND AND J. P. ALLCHIN. *Mineralog. Mag.*, **25** [170] 584–96 (1940).—Evidence is given which shows that the blue tint in many samples of celestine, halite, and anhydrite is due to colloidal gold. Spectrographic and chemical analyses were made of gold and other elements. From analyses of these and other minerals it is concluded that gold is more widely distributed than was formerly supposed. L.R.B.

Discussion of "Flotation of barite from Magnet Cove, Arkansas." H. S. SPENCE, L. R. HARRISON, AND O. C. RALSTON. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1412; *Mining Tech.*, **5** [6] 3–4 (1941). **Reply.** J. NORMAN. *Ibid.*, pp. 4–5. See *Ceram. Abs.*, **20** [11] 270 (1941).

Experiments on the consolidation of clay. L. F. COOLING AND A. W. SKEMPTON. *Jour. Inst. Civil Engrs.* [London], **16** [7] 381–98 (1941).—Terzaghi's theory of moist soil consolidation is explained. Tests with oedometers are described in which a disk of London clay slurry was compressed between two porous stone disks 3 or 4 in. in diameter at discrete pressures up to 4 tons. Conclusions are as follows: (1) the time-consolidation relation agrees with theory within reasonable practical limits; (2) the rate of consolidation varies inversely as the square of the thickness of the sample; (3) the coefficient of consolidation is a constant for the material and, within practical limits, is independent of the pressure and thickness of the sample; and (4) the pressure-voids ratio relation is independent of the thickness of the sample. According to Terzaghi's theory, the degree of consolidation, μ, is a function of ct/d^2, where c = coefficient of consolidation, t = time of application of load causing consolidation, and d = "drainage path," i.e., the distance the pore water must travel before losing its hydrostatic pressure generated by the applied pressure. E. N. Fox has shown that $\mu = 2\sqrt{ct/\pi d^2}$. If μ is plotted against $\sqrt{t}$, the first half of the curve is a straight line from the slope of which c can be calculated and the theoretical curve can be drawn. Terzaghi found that some soils departed from the theoretical requirements, but the London clay deviates only slightly at later stages of consolidation. L.R.B.

Method for the preparation of thin sections of clays. A. V. WEATHERHEAD. *Mineralog. Mag.*, **25** [169] 529–33 (1940).—The process is based on the method of preparing cellulose "peels" of fossil plants. The dry-clay specimen is ground smooth on ground-glass plates, flooded with amyl acetate and then with pyroxylin, and allowed to dry. A "peel" is then removed and mounted in balsam as usual; more than usual care is taken to attain the correct temperatures by attaching a thermometer to the copper plate for melting the balsam. The section is not of uniform thickness, as detrital quartz grains are pulled out whole. The chief value of these sections lies in the possibility of examination of the matrix for the first time under high power. In some clays the matrix consists of spherulites in the form of "mangle-wheel" crosses. Chalk sections have also been prepared. L.R.B.

Plasticity of clays. E. A. HAUSER AND A. L. JOHNSON. *Jour. Amer. Ceram. Soc.*, **25** [9] 223–27 (May, 1942).—7 references, 3 figures.

Reconditioning zeolites which have lost base-exchange capacity due to contamination. A. KLEIN. *Jour. Soc. Chem. Ind.* [London], **60** [10] 262–63 (1941).—Zeolites contaminated by water containing dissolved iron or having an alkalinity sufficient to give a red color to phenolphthalein can be restored by treatment with H_2SO_4, sodium aluminate, and sodium silicate solutions. L.R.B.

Recovery of titania from bauxite wastes. P. C. DAS-GUPTA AND H. N. DAS-GUPTA. *Jour. Indian Chem. Soc., Ind. & News Ed.*, **4**, 16–20 (1941); *Brit. Chem. & Phys. Abs.-B*, **I**, 444 (Oct., 1941).—Extraction of TiO_2 from Bayer-process residues (called lux) (containing 16% or 40% TiO_2 from unroasted or roasted bauxite, respectively) by heating with aqueous $NaHSO_4$ until all H_2O is evaporated, heating to 300°, and digesting the friable mass with 10% H_2SO_4 was 24.4, 31.0, 82.4, and 100% when the ratio $NaHSO_4$:lux was 1, 2, 3, and 4:1, respectively. Maximum recovery of TiO_2 after dilution and hydrolysis was 91% when the ratio $NaHSO_4$:lux was 3:1 and 74% when it was 4:1. The process is suitable for large-scale operation with lux or residues from alum manufacture. Heating lux with dry $NaHSO_4$ (1:5) at 400° to 450° resulted in 12.4% extraction, while extraction with H_2SO_4 requires large amounts of acid and energetic boiling, the latter producing much fume.

Resistant films from clays. ANON. *Chem. Age* [London], **46** [1181] 89 (1942).—Three patents on strong flexible clay films (*Ceram. Abs.*, **21** [2] 51 (1942)) are described. A.B.S.

Specific surface of fine powders. F. M. LEA AND R. W. NURSE. *Jour. Soc. Chem. Ind.* [London], **58** [9] 277–83 (1939).—Carman's method for determining the specific surface of powders ("Determination . . . ," *Ceram. Abs.*, **18** [10] 274; [7] 195 (1939)) was applied to cements. It was found necessary to adopt a gaseous medium, as a liquid medium gave higher values for specific surfaces above 1000 sq. cm. per gm. A comparison of the Wagner photoelectric sedimentation method and the Andreasen sedimentation method with the air-permeability method for specific surface shows that the last two give results in good agreement if Andreasen's definition of particle diameter is used. If particle size distribution curves are not required, the air-permeability method offers the advantages of speed and reproducibility. The method should be suitable for other powders of similar surface area. See "Comparative . . . ," this issue, p. 119. L.R.B.

Structure of orthoclase. S. H. CHAO, A. HARGREAVES, AND W. H. TAYLOR.* *Mineralog. Mag.*, **25** [168] 498–512 (1940).—Quantitative X-ray methods were applied to a clear crystal of typical orthoclase containing 6.5% soda feldspar and 2.5% lime feldspar. As expected, the structure is similar to sanidine (previously qualitatively determined). The specimen possesses monoclinic symmetry with $a = 8.60$, $b = 13.02$, and $c = 7.22$ a.u. The space group was assumed to be $C_{2h}^3 = C2/m$. The new results are tabulated and shown in contoured graphs of electron density, which are discussed; bond lengths are given. L.R.B.

Theory of clay consolidation accounting for secondary compression. D. W. TAYLOR AND W. MERCHANT. *Jour. Math. & Phys.*, **19**, 167–85 (1940); *Brit. Chem. & Phys. Abs.-B*, **I**, 291 (July, 1941).—Consolidation-time curves obtained when clay specimens are subjected to successive vertical load increments in conditions of rigid lateral support and free top and bottom drainage are in agreement with Terzaghi's theory during the early stages of compression for each increment, but a further (secondary) compression ensues after prolonged loading. The secondary compression can be quantitatively accounted for by a modification of the standard theory taking into account breakdown of the clay structure due to shearing strains. The application of the theory to settlement under building loads is discussed.

PATENT

Flotation of magnesite and the like magnesium ores. A. W. FAHRENWALD (Northwest Magnesite Co.). U. S. 2,280,905, April 28, 1942 (April 16, 1941).

Chemistry and Physics

Application of colorimetric methods to metallurgical analysis. E. TAYLOR-AUSTIN. *Jour. Soc. Chem. Ind.* [London], **60** [2] 29–39 (1941).—The object of the investigation was (1) to examine and standardize the colorimetric procedures used in the examination of ferrous alloys, slags, refractories, and sands so that final color measurement could be carried out by means of a form of colorimeter and (2) to study the applicability of a new type of

Lovibond tintometer to such procedures; this new instrument is described. After suitable standardization, it was found that the tintometer could readily be applied to all the procedures examined and that standardization curves could be prepared by plotting only the predominant color employed against the amount of any given element present; secondary colors and the amount of dimming had no influence on the curves, which in all but two cases showed a linear relationship between the color and the amount of the element present in the test solutions. The Lovibond-Schofield tintometer gives the quantity of any color in international (Commission Internationale de l'Éclairage, 1937) units. The determination of the following elements is described in detail (the reagents appearing in parentheses are those chiefly concerned in the production of the colors with each metal ion): titanium (H_2O_2), chromium (diphenylcarbazide), manganese (potassium periodate), copper (sodium diethyldithiocarbamate), iron (thiocyanate and thioglycolic acid), and aluminum and phosphorus in residues from general metallurgical analysis (aurine tricarboxylate and stannous chloride plus ammonium molybdate, respectively). The determination of vanadium was not attempted, because, to prevent interference by titanium, HF must be added, which attacks the glass cell of the tintometer. L.R.B.

Colorimetric determination of readily soluble phosphate in soils. E. G. Williams and A. B. Stewart. *Jour. Soc. Chem. Ind.* [London], **60** [11] 291–92 (1941).—The phosphate present in dilute acetic acid extracts of soils was estimated by direct and indirect colorimetric methods and by a titrimetric method. A comparison of the results indicates that the direct colorimetric procedure, necessitating no pretreatment of the extracts, is suitable for most purposes. The usual method involving the reduction in acid solution of phosphomolybdic acid to the blue complex is employed. L.R.B.

Determination of carbon monoxide in products of combustion of town's gas. E. C. Roberson. *Jour. Soc. Chem. Ind.* [London], **57** [2] 39–43 (1938).—Anomalies occurring in the determination of CO in products of combustion by the iodine pentoxide method are caused chiefly by (*a*) CO contained in the N_2 used for purging the sample from the reaction train, (*b*) nonremoval of acid spray from gas washers, (*c*) incomplete reaction between the CO and iodine pentoxide, and (*d*) large variations in the time required to sweep similar samples through different trains. A new apparatus and technique are introduced to eliminate these disturbing effects, and the possible sources of error in the new method are investigated and discussed. L.R.B.

Determination of cerium in monazite sand. M. O. Axt. *Jour. Soc. Chem. Ind.* [London], **60** [8] 229–30 (1941).—The sample is attacked by concentrated H_2SO_4, and after Th, Sc, Yt, and rare earths are separated with oxalic acid it is dissolved in dilute H_2SO_4; the oxalic acid is destroyed with ammonium persulfate, and the Ce^{III} is oxidized to Ce^{IV} with ammonium persulfate and titrated with 0.1 or 0.05 *N* $FeSO_4$, using *o*-phenanthroline-ferrous complex as indicator. This is an improvement on the method of Willard and Young. L.R.B.

Determination of iron in resistant silicates. M. H. Hey. *Mineralog. Mag.*, **26** [175] 116–18 (1941).—The method of H. P. Rowledge for determining ferrous iron in difficultly soluble silicates (*Ceram. Abs.*, **16** [1] 44 (1937)) consists in fusing the sample at 900°C. in a sealed Pyrex-brand glass tube with NaF and B_2O_3, subsequently dissolving the cake in hot dilute H_2SO_4 in a current of CO_2, and titrating with $KMnO_4$. When very small amounts of mineral are available, it is best to evacuate the Pyrex-brand glass tube and to dissolve the crushed cake after fusion in an excess of 0.005 *M* ICl in 1:1 HCl followed by strong HCl. CCl_4 is added as indicator, and the solution is titrated with 0.0005 *M* KIO_3 according to the equation $4Fe^{\cdot\cdot} + IO_3' + 6H^{\cdot} + Cl' = 4Fe^{\cdot\cdot\cdot} + 3H_2O + ICl$. The ICl thus serves to prevent air oxidation of the ferrous ion. L.R.B.

Determination of small amounts of manganese by sodium fluoride. Josef Hoffmann. *Sprechsaal*, **74** [15] 155–57 (1941).—H. discusses manganese colors caused by traces of manganese in sodium fluoride beads, which are probably a sodium-manganese fluoride composition. With a manganese content of 2.5 γ per 25 mgm. bead, they show a strong blue-green color. A manganese content of 0.25 γ per 25 mgm. bead gives an uneven, weak, green-tinted blue color. With a manganese concentration of 0.025 γ per 25 mgm. bead, there is a less characteristic manganese color. A welcome peculiarity of this oxidized melted sodium manganese glass is that beads with a manganese content of 0.25 γ per 25 mgm. bead may be bleached by a simple reducing action for 2 sec. so that manganese concentrations of 0.0000025 gm. per bead may be distinguished from a concentration of 0.00000025 gm. per bead. In preparing sodium fluoride beads of 25 mgm., weighing is not always necessary; they may be made by using a platinum loop 3 mm. in diameter. To distinguish between the glass colors, for manganese concentrations between the given limits, it is expedient to compare the test glasses (about 4 to 6 at a time) with the standard bead, using a white background to facilitate the comparison. It is also suggested that the iron ions in the test glass may influence the manganese color; since they are more easily separated out in the analysis, however, than the traces of manganese which go into the filtrate when precipitating with ammonium carbonate, coloration due to iron may be avoided. W.H.H.

Frictional phenomena: VII, Viscosity of colloidal solutions. Application to synthetic polymers. Andrew Gemant. *Jour. Applied Physics*, **13**, 90–96 (1942).—Colloidal particles present in solutions and suspensions increase the effective viscosity of the solvent. Einstein has presented the theory of this effect valid for spherical particles and has given an equation which does not fully account for solvation or electric charge effects. Elongated particles require a further modification. The theory is being successfully applied to the study of synthetic fiber molecules, and information on their shapes can be derived from viscometric measurements. For Part **VI** see *Ceram. Abs.*, **21** [5] 110 (1942). A.P.

Gas-volume method for determination of carbonate in calcareous minerals. G. E. Bessey. *Jour. Soc. Chem. Ind.* [London], **58** [5] 178–80 (1939).—B. describes an improved method of determining CO_2 in calcareous minerals which involves measuring the CO_2 evolved when the material is heated with a mixture of K_2SO_4 and H_2SO_4. It is suitable for materials liberating CO_2 only. These include limes, limestones, Portland cement, and sand-lime brick. L.R.B.

Indexing powder diffraction patterns of isomorphous substances. L. K. Frevel. *Jour. Applied Physics*, **13**, 109–12 (1942).—Two methods of indexing powder diffraction patterns of isomorphous substances are as follows: (1) matching the log *d* values of two or more isomorphs (*d* being the interplanar spacing of a given reflection) and (2) relating the spacing shifts $\Delta d/d$ of two isomorphs to the symmetry of the particular crystal system. The proposed methods have direct application to the identification of crystalline solids by X-ray diffraction. A.P.

Saga of salt—story of the Mathieson Alkali Works. Anon. *Chem. Industries*, **50** [2] 184–93 (1942).—14 illustrations. E.D.M.

Twenty years' progress in alkali technology. David Aronson. *Chem. Industries*, **50** [3] 324–31 (1942).—The ammonia-soda, electrolytic, and natural processes for the production of the common alkali salts are discussed. A. deals essentially with the economics of the various processes, particularly the influence of the chlorine market on the method of production. E.D.M.

PATENTS

Preparation of fluorescent coating material. W. L. Sullivan (Westinghouse Electric & Mfg. Co.). U. S. 2,279,877, April 14, 1942 (March 1, 1940).—The method of preparing a mixture of fluorescent material comprising calcium tungstate having substantially maximum fluorescent output which consists in forming a mixture of tungsten oxide and calcium oxide, controlling the exothermic reaction by preselecting the water content of the mixture

to a value approximating 3 to 5% by weight of the mixture, and firing the mixture at a temperature ranging from 950° to 1100°C.

Preparation of pigments comprising rutile titanium dioxide. S. S. COLE AND W. K. NELSON (National Lead Co.). U. S. 2,280,795, April 28, 1942 (Aug. 7, 1937).—Method for the preparation of a pigmentary composition comprising rutile titanium dioxide and a thermally produced combination of zinc oxide and titanium dioxide which comprises heating between about 430° and 775°C. a mixture of a reactive zinc compound and anatase titanium-oxygen compounds, in which the ZnO content is not less than between 20 and 28.5% of the total weight of ZnO and TiO_2, until a solid solution of titanium dioxide in zinc orthotitanate is formed, mixing the so-produced solid solution with further amounts of anatase titanium-oxygen compounds, and heating the resulting mixture above temperatures which can be represented on a graph where the abscissas are temperatures from 750°C. at the bottom to 1075°C. at the top and the ordinates are per cent compositions varying in regular proportional integers from 100% TiO_2 and 0% ZnO at the left to 0% TiO_2 and 100% ZnO at the right by a curve drawn through the following points of intersection:

Abcissas	Ordinates
770°C.	99% TiO_2: 1.0% ZnO
772	90 " :10 "
775	80 " :20 "
780	70 " :30 "
792	60 " :40 "
827	50 " :50 "
925	40 " :60 "
1050	33.3 " :66.7 "

until a conversion of anatase titanium-oxygen compounds to rutile titanium dioxide is discernible by means of an X-ray examination.

General

Absorption, accumulation, and excretion of ingested silica. J. L. WEBB ET AL. *Jour. Ind. Hyg. & Toxicol.*, **24,** 43–45 (March, 1942).—Ingested silica causes no cataract or other pathological changes in rats, nor does it have any influence on their growth rates. A certain fraction of the ingested silica can be absorbed from the gastrointestinal tract; most of this is excreted in the urine, but a small amount is accumulated in the tissues. The liver and spleen are the most active in this regard. F.S.M.

Edward Mathews Ayers. ANON. *Bull. Amer. Ceram. Soc.*, **21** [4] 49–50 (1942).

Ceramics aid wartime construction. ANON. *Ceram. Ind.*, **38** [4] 58, 75–78 (1942).—Ceramic materials used for wartime construction are enumerated. Illustrated. H.T.

Ceramics with the armed forces. ANON. *Ceram. Ind.*, **38** [4] 44–49 (1942).—Ceramic materials used by the Army and the Navy are enumerated. Illustrated. H.T.

Ceramics fighting on the home front. ANON. *Ceram. Ind.*, **38** [4] 79–84 (1942).—Porcelain enamel can be substituted for copper and zinc, and glass gives excellent service where metals were formerly used. Numerous examples are cited. Illustrated. H.T.

Ceramics help industry produce for defense. ANON. *Ceram. Ind.*, **38** [4] 51–56 (1942).—Ceramic products used in the production of war materials are enumerated. Illustrated. H.T.

Conservation of hearing in industry. C. C. BUNCH. *Jour. Amer. Med. Assn.*, **118,** 588–93 (Feb. 21, 1942).—B. notes an ostrich attitude on the part of employers and employees toward the effects on hearing of certain industrial hazards. Conditions which adversely affect hearing include extreme and rapid variations in temperature without adequate protection, resulting in upper respiratory infection; sudden wide variations in atmospheric pressure (experienced by caisson workers, aviators, etc.); and extremely loud noises. Cases involving occupational loss of hearing are appearing before the courts, and compensation boards are making awards for this affection. F.S.M.

Control of hazardous substances by low-velocity exhaust systems. J. M. DALLA VALLE. *N. Y. State Dept. Labor Ind. Bull.*, **21,** 83–84 (Feb., 1942).—Attention is called to a method of exhaust ventilation which may be applied in many plants having difficulty in obtaining material for constructing the usual type of high-velocity exhaust system. A system developed by Hatch (*Ceram. Abs.*, **20** [4] 107 (1941)) is discussed. The distinguishing feature of the Hatch system is the use of low air velocities; it dispenses with the principle of pneumatic conveying which is the common characteristic of the usual type of exhaust system. Its advantages are as follows: (1) Since ultimate control depends upon the provision of air volume at the source of contamination, the low-velocity system eliminates small openings and branch pipes, thus reducing losses sustained at the entrance and in the pipe system; the system requires less power. (2) The system may be constructed of materials other than sheet metal, e.g., plywood or masonite. (3) Propeller fans may be used in place of the usual type of centrifugal blower. (4) The cost of operation is reduced. The disadvantages are as follows: (1) More space is required than with a high-velocity system. Since velocities as low as 200 l.f.m. may be maintained, this means a cross-sectional area 20 times that of a high-velocity system pr ɔvi lin ɾ for 4000 l.f.m. (2) A means of perio lic or continuous cleaning of accumulated debris, if the system is used for collecting dust, must be provided. (3) The system is better adapted to new installations than to existing ones, since in most cases equipment must be laid out to fit the system. In a high-velocity system, the procedure is the reverse. F.S.M.

Coproporphyrinuria and hemoglobin metabolism in experimental lead poisoning. S. E. BJORKMAN. *Acta Med. Scand.*, **108,** 568–79 (1941).—Porphyrin excreted in the urine in lead poisoning is exclusively coproporphyrin, which is chemically identical with blood porphyrin. B. conducted experiments on rabbits to clear up the controversial question of its origin. Coproporphyrin appeared in the urine some days after the beginning of lead intake, and after a rapid use kept at the same level during other changes such as decrease in hemoglobin and red cell count and increase in reticulocytes and stippled cells. Intravenous application of hemoglobin caused no alteration. There is therefore no direct connection between porphyrin synthesis and hemoglobin metabolism. The only theory supported by the experimental results is that of Waldstroem, who held that porphyrinuria is caused by a disturbance in the metabolism cytochrome which is necessary for cell respiration. F.S.M.

Dangerous dust hazards still exist in whiteware manufacturing plants. L. M. MERRITT. *Ceram. Ind.*, **38** [3] 56 (1942); see "Dust . . . ," *Ceram. Abs.*, **20** [8] 206 (1941). H.T.

Dental status of adult male mine and smelter workers. H. P. BRINTON ET AL. *U. S. Pub. Health Repts.*, **57** [7] 218–28 (1942).—In an extensive, detailed study of the work environment and health of workers in bituminous coal mines, nonferrous metal mines, and metal smelters in Utah (made in 1939 by the U. S. Public Health Service in cooperation with the State Board of Health), careful attention was given to the oral conditions recorded in 2365 dental examinations. In the same year the dental status was published of 228 male pottery workers and 205 female employees of one of the nine pottery factories of West Virginia previously investigated by the U. S. Public Health Service (see "Silicosis . . . ," *Ceram. Abs.*, **19** [1] 34 (1940)). Comparable data for similar age groups in other industries and in the general population are lacking, making it difficult to place relative values on dental findings. Ninety-three per cent of the edentulous workers in coal mines, nonferrous metal mines, and smelters wear artificial

dentures compared with 99% of the male pottery workers. Of the 366 edentulous workers examined, 15.5% had lost their teeth in both jaws, while the figure for the 228 male pottery workers was slightly more favorable (12.3%). K.R.

Dust problems in industry as related to the coroner. C. O. SAPPINGTON. *Ind. Med.*, **11** [3] 127–30 (1942).—Numerous industrial surveys have shown that industrial exposure to dust is more prevalent than exposure to any other injurious substance. Only two types of dust produce disease, free silica dust and asbestos dust, the clinically recognizable diseases therefrom being silicosis and asbestosis. The coroner, as a pathologist, is concerned with the end results of disease as shown in autopsy findings. He is therefore able to corroborate clinical statements or to render them negligible or erroneous. Three case histories are cited in detail. Case 1 was a 38-year-old fireman in the power plant of a pottery. Contributory causes of his death were named as pneumoconiosis and emphysema of the lungs. The clinician also stated on the death certificate that the disease was probably related to the occupation of the deceased. Autopsy revealed acute pericarditis as the direct cause of death, with a background of chronic kidney and heart involvement. No silicosis hazard whatever was evidenced in the patient's occupation. Case 2 concerned a pottery worker whose occupation was known to produce silicosis, but neither the stereoroentgenograms nor the autopsy findings indicated the presence of pulmonary silicosis. Enough free silica to produce silicosis, however, was found in the lungs by an X-ray diffraction test. In case 3 the occupational history gave no information relative to a silicosis hazard. Both X-ray and autopsy findings showed an advanced silicosis without, however, any superimposed pulmonary infection. Death was due to cardiovascular disease, together with cerebral complications. S. urges the use of specific terminology in diagnosis and the filling out of death certificates in strict accordance with autopsy findings. K.R.

Evaluation of the lead hazard in the decorating department of a glass plant. Relation of urinary and atmospheric lead determinations. C. A. SMUCKER AND J. B. KISTLER. *Jour. Ind. Hyg. & Toxicol.*, **24**, 1–4 (Jan., 1942).—Lead concentrations were determined in the air of a large glass-decorating department, where a lead oxide flux was sprayed on glassware and fused into the glass. They were compared with the urine lead concentrations of 24 employees selected at random from that department. The ratio of lead exposure to excess lead in urine as determined for this group of employees is in excellent agreement with that previously determined by other workers for a group of employees in miscellaneous industries. These results suggest the possibility of applying urinary lead findings on an adequate group of employees for evaluating industrial lead exposures. The significance of these results is substantiated by a high incidence of lead poisoning reported among employees of the department. F.S.M.

Experimental air-borne disease. Quantitative natural respiratory contagion of tuberculosis. W. F. WELLS AND M. B. LURIE. *Amer. Jour. Hyg.*, **34**, 21–40 (July, 1941).—Apparatus and methods for the study of quantitative natural air-borne contagion are discussed with regard to respiratory infection in tuberculosis. They estimate with constancy and considerable accuracy the "dose" of naturally inhaled infection units. The survival period, the preallergic interval, and the type and prognosis of the ensuing disease are functions of the dose of naturally inhaled microorganisms. With exposure to small known doses, the disease reproduces that occurring in rabbits of different inherited natural resistance when exposed to infected cage mates. This disease in the susceptible rabbits has the characteristics of a first infection and resembles progressive primary tuberculosis in man. In the resistant rabbits, it pursues a more chronic course, resembling reinfection tuberculosis or adult pulmonary phthisis in man. When pure cultures of tubercle bacilli suspended in the air are exposed at an average distance of 5 cm. (120 millimicrons per sq. cm.) for 3 sec. to ultraviolet light of the 2537-a.u. wave band, 94% are killed. F.S.M.

Fibrotic nodules in the tracheobronchial lymph glands of the mouse produced by breathing precipitated silica. J. A. CAMPBELL. *Brit. Jour. Expt. Path.*, **22**, 76–80 (1941).—Silica dust produced fibrotic nodules in the tracheobronchial lymph glands of 50% of 75 mice. The nodules resembled typical human silica nodules. Six photos show the histological picture at different stages of development. No nodules were produced in the lungs, probably because the dust was first removed to the glands and the amount inhaled was insufficient to affect the lungs also. Silica was deposited in different parts of the gland at different periods. These experiments support the specificity theory for silicosis. 16 references. F.S.M.

Harry Ward Foote. *Amer. Jour. Sci.*, **240** [4] 302–308 (1942).—An obituary. B.C.R.

Heavy clay products—classes of products and their similarities and differences from a technical and commercial viewpoint. A. MÖSER. *Sprechsaal*, **74** [18] 185–87; [19] 193–94 (1941).—Ceramic ware may, in general, be divided into two classes, i.e., heavy clay products and fine ceramics, although there are border cases (wall tile and porcelain insulators) which are hard to classify. Heavy clay products are divided into brick, stoneware, and refractories. There are minor differences in materials and methods, but they are all made of clay which becomes plastic on the addition of water and retains its form after drying and firing. In addition to common building brick, there are face brick, hollow tile, and roof tile. Stoneware includes drainpipe and acid-resisting ware for technical purposes. Refractories vary according to size and the temperature to which they are exposed. A great variation in raw material is permissible with building brick. A clay may be too pure to be used by itself because of high shrinkage. For hollow ware, the content of aluminum silicate must be high and the quartz content must not be too great. In the stoneware industry, the raw material may vary only within narrow limits because the ware is fired to vitrification; if the ware is to be acid resistant, attention must be paid to the chemical composition of the clay. With refractories, the physical and chemical composition of the raw material is the main consideration. These differences in required characteristics of the raw materials tend toward the segregation of different branches of the ceramic industry in different localities. Material for building brick requires the least preparation; sufficient disintegration may often be obtained by wintering. In most cases, the combination of a conveyer and crushing rolls is adequate. The auger machine accomplishes both mixing and forming. With hollow ware a more thorough preparation is needed to reduce wear of the die and to prevent too great a loss from breakage because of inner stresses in drying. For acid-resistant stoneware, the wet process must often be abandoned because the required uniformity of mixture cannot be obtained. The wet process is seldom used for floor tile or for refractories. Brick and hollow tile are formed by the die. With more valuable and complicated articles, machinery plays a less important part, and forming is accomplished by hand. Drying may be the most important process in manufacturing. With ware produced in great quantity, such as brick, there is relatively little heat available for drying. With stoneware, the firing temperature is higher, and the problem of obtaining heat enough for drying is less difficult. There is an abundance of waste heat in the refractories industry, but variations in the product, and thus in the times of drying, make it difficult to utilize the waste heat. The firing requirements vary with the product. With brick, it is necessary only to attain the desired highest firing temperature; for stoneware, the change between reducing and oxidizing conditions is of the greatest importance in securing the desired characteristics of the ware. The cheaper fuels can be used for firing brick; the best fuel is required for refractories. In obtaining the raw material, it is economical to use an excavator when the material occurs in thick enough layers, but it is not practical to transport the raw material from great distances. In the refractories industry, the important factor is the economic procurement of the necessary grog, as this may amount to 60 or 70% of the mix. In the brick industry, transporta-

tion of the finished product is an especially important matter. It may be of greater importance economically than any technical question concerning the manufacture of brick. Ordinary building brick are in a class with iron, coal, and cement as key products of national economy. W.H.H.

How Scio makes pottery. ANON. *Ceram. Ind.*, **38** [2] 40–44, 48–55 (1942).—A description of Scio-Ohio Pottery Co. plant and its unique history is given. Diagrammatic layouts show the flow of ware through the plant and the efficient mechanical handling of goods. An automatic jigger machine produces 14,000 dozen pieces of ware per day. Illustrated. H.T.

Indiscriminate administration of vitamins to workers in industry. AMERICAN MEDICAL ASSN. COUNCIL ON FOODS AND NUTRITION AND COUNCIL ON INDUSTRIAL HEALTH. *Jour. Amer. Med. Assn.*, **118,** 618–21 (Feb. 21, 1942).—Satisfactory evidence of the wisdom of the general practice of providing all employees of industrial concerns with vitamins indiscriminately is lacking. When a satisfactory study of any given industrial situation indicates the wisdom of providing vitamins to employees, the Councils point out the necessity of observing the proper scientific limitations of such action; after the employee has been restored to a healthful state, the use of a good diet of natural protective foods thereafter should suffice. Nothing in this report is intended to belittle the significance of vitamins in nutrition or the value of the proper use of added vitamins in improving foods such as bread and flour. The need for the avoidance of indiscriminate mass use of vitamins, a practice which supports the commercial exploitation rather than scientific rational use of these important dietary factors, is emphasized. F.S.M.

Industrial "lifeguards" meet in Cincinnati. ANON. *Bull. Amer. Ceram. Soc.*, **21** [4] 57 (1942).

Judge trademark infringement on deception, not similarity. LEO T. PARKER. *Ceram. Ind.*, **38** [3] 59–60 (1942).—Recent decisions by the higher courts show that identical trademarks may be used on noncompeting ware without infringement. Courts uphold unregistered trademarks in the territory in which goods have been sold. Various court cases are reviewed. H.T.

Lung function in silicosis. E. ROELSEN. *Proc. Medical Congr. Northern Countries, 19th Congr., Oslo, June, 1939; Acta Med. Scand., Supp.*, No. 123, pp. 236–43 (1941).—R. reports the principal results of lung-function tests on 40 or 50 silicotic patients, including porcelain workers, stonemasons, sandblasters, and foundry workers. He found a decrease in vital capacity and an increase of residual air, especially in the second and third stages of the disease. The explanation lies in the decreased motility of the thorax wall and diaphragm, causing a diminution of lung elasticity. The difference in alveolar ventilation of different sections of the lung is generally increased, considerably so in the second and third stages. Lung functions are not as severely affected in silicotics as in emphysema patients. See *Ceram. Abs.*, **20** [3] 78 (1941). F.S.M.

Methods of avoiding corrosion. ANON. *Product Eng.*, **13** [4] 192–235 (1942).—In a discussion on means of conserving metals by preventing their corrosion, the following principal methods are mentioned: (1) organic coatings on carbon steels, (2) porcelain enamels on stampings and castings, (3) glass for floats, springs, and mechanical parts, (4) molded porcelain where both dielectric strength and corrosion resistance are required, (5) plastics such as Saran to replace brass and copper tubes, (6) high-silicon case on steel produced by heat-treatment as in the Ihrigizing process, (7) thin lead coatings produced by dipping as by the Hurbenium process, (8) chemical surface treatments such as bonderizing, parkerizing, black magic, jetal, and others, and (9) silver plating or cladding on base metals for corrosion resistance. Many practical examples are described, including glass tubing to replace nickel-chromium tubing for protecting sheaths for thermocouples; this Vycor glass is 96% SiO_2, the remainder being chiefly B_2O_3. It has a softening point of 1510°C. ± 30°, an annealing point of 890°C. ± 20°, a strain point of 790°C. ± 20°, a density of 2.18, and a coefficient of linear expansion of 7.8 to 8 × 10^{-7}; the maximum temperature at which it can be used for limited periods is 900° to 1000°C. M.H.

New treatment for burns (preliminary report). K. L. PICKRELL. *Bull. Johns Hopkins Hosp.*, **69,** 217–24 (Aug., 1941).—The method of treatment involves the application of 3% sulfadiazine in 8% triethanolamine by spraying. Full details of the immediate and later treatment are given. In the opinion of the surgical staff, the burned areas of the 115 patients healed more rapidly than they would have with any other form of treatment used at the hospital. F.S.M.

Pathogenesis of heat disease in man. B. SCHLEGEL AND H. BOETTNER. *Deut. Arch. klin. Med.*, **187,** 193–205 (1941).—The effects of heat are divided into three classes: exhaustion, stroke, and cramps. The authors conducted 50 experiments on 35 persons to study the behavior of the human body at the stage just prior to heat stroke and heat exhaustion. The subjects were kept in a chamber at a temperature of 40°C. (104°F.), for 2 hr. when possible. Losses through the skin amounted to 11 gm. sodium chloride, 430 mgm. nitrogen, and up to 2700 gm. water. Most of the persons complained of symptoms referable to the nervous system, including palpitation, oppression, dizziness, and fatigue. The body temperature in some cases rose to 38.5°C. (101.3°F.), but the rise was not related to heat tolerance. The pulse rate, however, rose sharply to 176 at the point where the heat could not be tolerated; in resistant persons 140 was the upper limit. In a few persons on whom the experiment could be conducted to a stage of imminent collapse, a strong decline of the systolic and diastolic pressure was seen. All the observed phenomena indicated that the blood goes to the diluted peripheral vessels, while those in the internal organs, including the brain, are contracted. The characteristic of heat exhaustion is a breakdown of the circulatory regulation with an intact temperature-regulation system. The syndrome of heat stroke consists of failure of the temperature-regulating system combined with long resistance of the circulatory regulation. Exhaustion of sodium chloride reserves is the important feature in heat cramps. The authors believe that the organ primarily damaged by heat is the adrenal cortex. F.S.M.

Pneumoconiosis—a study of 379 cases. H. B. WILLIAMS. *Med. Bull. Veterans' Admin.*, **18,** 250–53 (Jan., 1942).—A survey was made to determine the relative incidence of pneumoconiosis in beneficiaries of the Veterans' Administration. A review of 379 cases of individuals who had been exposed to numerous occupational dust hazards is presented. Of this number, 179 cases were classified as pneumoconiosis, either uncomplicated or complicated by infectious disease. A detailed system of classification is included. No definite conclusions are drawn, but the data support the belief that pneumoconiosis increases susceptibility to tuberculosis in a direct ratio. W. stresses the need for more careful and detailed histories and physical examinations. F.S.M.

Preparation of slides for particle-size determination. L. SILVERMAN AND W. FRANKLIN. *Jour. Ind. Hyg. & Toxicol.*, **24,** 51 (March, 1942).—It is suggested that, in following Green's technique of preparing slides for particle-size determination, it is possible to crush particles of the range 1 to 10 microns. This seemed to be borne out by a comparison of the results of counts made on slides prepared by evaporation of suspensions and by mechanical dispersion. F.S.M.

Significance of porphyrinuria in lead poisoning. R. KARK AND A. P. MEIKLEJOHN. *Jour. Clin. Investigation*, **21,** 91–99 (Jan., 1942).—Solutions of hemoglobin were injected into two subjects with lead poisoning, anemia, and porphyrinuria. The injection was followed by a rise in plasma bilirubin resembling closely both in degree and time of onset the bilirubinemia which has been observed in normal subjects under comparable conditions. It was also accompanied by transient increase in urinary urobilinogen excretion. The injection resulted in no detectable increase in the excretion of coproporphyrin either in the urine or feces. These results failed to demonstrate any

interruption in the path by which hemoglobin is destroyed in the body. It is therefore concluded that the porphyrinuria occurring in lead poisoning cannot be explained on this basis. The relation of these findings to the problem of the cause of anemia in lead poisoning is discussed. They lend support to the view that this anemia is dyshematopoietic rather than hemolytic in nature. F.S.M.

Silicosis among naval foundrymen. E. W. BROWN AND W. E. KLEIN. *U. S. Naval Med. Bull.*, **40**, 42–52 (Jan., 1942).—The findings of a medical survey of 454 employees of the steel and nonferrous foundries of the Naval Gun Factory, Navy Yard, Washington, D. C., are reported; they are based on occupational history, clinical examination of the lungs and heart, and radiographs of the chest. The occupational distribution was as follows: molders and molder helpers, 58.5%; helpers (general) and chippers, 18.2%; common laborers and electric cranemen, 9.4%; melters and sandblasters, 6.1%; and miscellaneous, 5.6%. The distribution according to total duration of silica-dust exposure was as follows: 68.6% had been exposed in other foundries prior to the present employment; 43.7% were in the 5- to 9- and 10- to 14-year duration exposure groups, and 45.7% were in the group ranging from 14 to 40 years and over. In reporting the X-ray findings, the U. S. Public Health Service classification was utilized: 86.3% of the cases fell in categories A and B, i.e., having normal lung markings or first- and second-degree exaggeration of linear pulmonic markings; 13.2% fell in categories C and D, showing the earliest indications of dust-induced pulmonary changes with fine discrete nodules stereoscopically and pathologically; and 0.4% were in category E, characterized by first-degree disseminated nodules up to the size of miliary tubercles. None was found in categories F or G. Eleven silicosis cases are reported by X ray, 10 first-stage and 1 second-stage; one case occurred in the 10- to 14-year exposure group and one in the 40-year exposure group. The incidence was 2.4%. Seventeen borderline cases were reported by X ray, an incidence of 3.7%; 82.3% of these fell in the occupational duration group of 25 to 29 years or above. The incidence of tuberculosis by X ray was 2.4% (11 cases); 1.1% was consistent with possible clinical activity, and 1.3% was of the healed or arrested reinfection type. F.S.M.

Vitamin supplementation of U. S. Army rations in relation to fatigue and the ability to do muscular work. A. KEYS AND A. F. HENSCHEL. *Jour. Nutrition*, **23**, 259–69 (March 10, 1942).—The recognition of borderline vitamin-deficiency states prompts the suggestion that a direct relation between the intake of certain vitamins and physical vigor may extend even above the subclinical deficiencies. During the past several years the popular belief has grown that a superabundance of these vitamins may produce extraordinary stamina or at least may be helpful in meeting physical or mental strain. These possibilities were of such obvious importance as to merit careful investigation. Studies were made under rigidly controlled conditions on personnel of the U. S. Army. Soldiers maintained on standard U. S. Army garrison rations were repeatedly subjected to standardized severe exercise on the motor-driven treadmill. Circulatory, metabolic, and blood chemical responses were measured. In a series of studies involving 256 experiments, large daily supplements of thiamine chloride, riboflavin, nicotinic acid, pyridoxime, pantothenic acid, and ascorbic acid were administered over periods of 4 to 6 weeks alternating with equal periods of placebo (harmless pill) administration. In neither brief extreme exercise nor in prolonged severe exercise and semi-starvation were there indications of any effects, favorable or otherwise, of the vitamin supplementation on muscular ability, endurance, resistance to fatigue, or recovery from exertion. Healthy young men expending an average of 3700 to 4200 calories per day are not benefited by a daily supply of more than 1.7 mgm. thiamine chloride, 2.4 mgm. riboflavin, and 70 mgm. of ascorbic acid. It is concluded that no useful purpose would be served by enrichment of the present U. S. garrison rations with the vitamins studied. F.S.M.

War emergency. ANON. War Production Board Release, March, 1942; *Bull. Amer. Ceram. Soc.*, **21** [4] 55 (1942); see *ibid.*, [2] 28–30.

Vocational guidance. ANON. *Sprechsaal*, **74** [13] 137–38 (1941).—There is a strong flow of apprentices to the trades of importance in war. To avoid labor shortages after the war in the fundamental fields of farming, mining, and building, measures have been officially taken to check this flow. Further measures must be taken to assure a supply of skilled workmen for the ceramic, glass, and enamel industries. There has been a great increase in the use of glass, ceramics, and porcelain as substitutes for metal, and it is expected that there will be further developments after the war. Various opportunities are offered in ceramics, e.g., in glass decorating, porcelain painting, and the development of building materials. A youth interested in chemistry would find a rich field in the research laboratories. One who has business inclinations may become a works manager. The refractory industry needs comprehensive chemical and technical knowledge. The manufacture of glass, stoneware, and porcelain apparatus requires the highest technical skill. Because of the competition between different trades, much greater care must be applied to education than previously thought necessary. The trade schools in the ceramic industry have a high standard and are well prepared to give a student the knowledge, ability, and education which he needs. W.H.H.

Working environment. M. A. SNELL. *Nat. Safety News*, **45**, 12–13, 66–70 (Jan., 1942).—S. discusses industrial hygiene, including the effects of dusts, fumes, vapors, and gases, atmospheric pollution, ingestion of toxic substances, dermatitis, and infectious and miscellaneous diseases. Reference is made to the American Standards Assn. standards for toxic materials and other recent work. See "Health . . . ," *Ceram. Abs.*, **19** [7] 155 (1940). F.S.M.

SEPARATE PUBLICATIONS

Annual Safety Equipment Issue, 1942. *Nat. Safety News*, **45**, 226 pp. (March, 1942).—Practically the entire issue is devoted to the description and display of safety equipment. Personal protective equipment, mechanical equipment, fire and plant protection, first-aid and medical service, sanitary equipment and supplies, and miscellaneous services and products are dealt with. F.S.M.

Engineers' Council for Professional Development—Report for the Year Ending September 30, 1941. Engineers' Council for Professional Development, New York, 1942. 48 pp. Price 25¢.—The list of engineering curricula accredited by the ECPD up to Oct. 30, 1941 (565 curricula at 129 colleges and universities) is given. The proceedings of the 1941 meeting include the report of the chairman; reports of the standing Committees on Engineering Schools, Student Selection and Guidance, Professional Training, and Professional Recognition; a preliminary report of the Committee on Engineering Ethics; report of the Committee on Information; financial statement for the year ending Sept. 30, 1941; and reports from representatives of the national engineering organizations sponsoring ECPD. The report also contains summaries of the addresses presented at the annual dinner; a list of the ECPD officers, representatives, and committee personnel for 1941–1942; the charter and rules of procedure of the ECPD, and a list of available publications. The Engineers' Council for Professional Development is a conference of engineering organizations formed to enhance the professional status of engineers through cooperative effort.

Outline of State Agencies Administering Labor Laws. ANON. *U. S. Dept. Labor, Div. Labor Standards, Bull.*, No. 49, 186 pp. (1941). Supt. of Documents, Govt. Printing Office, Washington, D. C. Price 40¢.—This bulletin is designed to acquaint individual workers, labor organizations, employers, state and federal administrators, community groups, and students with the general subject matter of state labor laws and the agencies administering them. No attempt has been made to analyze the laws in full. The brief listing of subjects, however, suggests certain standard types of laws. A list of the chief executive officers of the agencies is included. The outline is in loose-leaf form, so that revisions, which are to be issued at least once a year, may be easily inserted. F.S.M

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THE CRAFT POTTERS OF NORTH CAROLINA

Busbee, Hilton, and Stephen

The Influence of Oscar Louis Bachelder

Introduction

A few years ago, interest in the craft potteries of North Carolina was stimulated through the efforts of a member of the staff of the North Carolina State Department of Public Instruction who was engaged in an active campaign to identify art education with the practical commercial world as a way of life and who had led a movement in the State with a following that included a goodly number of leading artists, art directors and patrons, commercial designers, and hand and machine craftsmen to promote this philosophy.[1]

One of the most noteworthy activities of this movement was the provision of regional and state demonstration and discussion institutes held in schools and colleges. The American Ceramic Society was invited among others to demonstrate the practical and aesthetic values of ceramics.

In the spring of 1937, the annual meeting of the Southeastern Arts Association met in Raleigh, North Carolina. An invitation to The American Ceramic Society to participate was accepted. Exhibits and programs illustrative of the unique and the creative and of mass production had been arranged in harmony with the thought that art is a natural solution to everyday aesthetic needs and involves all of the activities of life.

It was fitting that North Carolina pottery had a prominent place in such an exhibit—fitting because of the excellent natural clay deposits found at fairly convenient subsoil depths throughout the State and fitting because of the rather prevalent practice of the potting industry, a survival from early days and what is known in art parlance as a "natural" for the Tarheel State.

It was most fitting, perhaps, because the moving spirit in the preservation and promotion of the early craftsman's skill and spirit, Juliana Busbee,[2] joined hands with the educators and assisted in the collection and arrangement of representative pottery for the occasion.

Mrs. Busbee, complimentary to the occasion, had arranged table settings of her ware as one phase of the All-North Carolina Arts and Crafts Banquet. Other outstanding craftsmanship was reflected in the products from the Hilton and Stephen potteries.

Recognizing the fact that here was a true folk art timeless in its adaptive value, sensing that standards for durability, form, and design could be improved, and aware that here was a natural avenue for education, professional and lay, The American Ceramic Society agreed to cooperate with the State Department of Public Instruction and the Extension Division of the University of North Carolina in the summer art institute at Blue Ridge, North Carolina, set up for "teachers and amateur artists"[3] for promoting "functional beauty in city and country life." The practice of some art, such as sketching, painting, modeling, writing, acting, casting, designing, gardening, and home decoration, was emphasized in the day's work.

The Art Division of The American Ceramic Society not only held its regular meeting at Blue Ridge, but was influential in securing the services of Kenneth E. Smith, Director of Ceramics at Sophie Newcomb College, New Orleans, Louisiana, to direct a course for six to twelve weeks at Blue Ridge in 1939 and in each succeeding year.

During the past four years, the Art Division of The American Ceramic Society has held two-day meetings at Blue Ridge. These meetings have afforded an opportunity for the study of materials, clays, and glazes, of processes and procedures in the production of ceramic artware, and for experimentation. Opportunities for first-hand experiences and college credit have been offered to young and old, free of charge.[4]

Is North Carolina's Ceramic Future to Be Different From the Past?

It is too early to evaluate the influence of the kind of effort described in the foregoing paragraphs as a factor influencing the level of craft products. Probably its greatest value lies in the stimulation of interest in general educational circles and lay groups.

This discussion is concerned rather with the fact that the Busbees at Jugtown,[5] the Hiltons at Marion, and Walter B. Stephen at Pisgah Forest are engaged in successful craft potting which deserves the attention of students. Their work explains or accounts for the unique place North Carolina holds in ceramic history. This article is devoted to a descriptive estimate of their work, and their success is emphasized as having philosophical and technical significance for educators and laymen.

Early History

The early North Carolinian potters were English and German. The English potters came in from the seaports, and the Germans migrated through the Shenandoah Valley over the mountains into Salem and then southwest to Hickory and to other towns in the Burke County Highlands. The English seem to have gone inland to Moore and Montgomery counties, where Steeds is the principal rural route post office.

Mr. Rice, in The Shenandoah Pottery, pages 271–77, presents extracts from diaries and other manuscripts found in the archives of the Moravian congregation at Bethabara and Winston-Salem and translated by Elizabeth L. Meyers. "February, 1756, stone was hauled to build a pottery." The dated diary accounts, which continue until September 25, 1779, tell how the natives crowded the town on the days of kiln drawing to barter for the ware. Many sadly returned home without obtaining any. The near-riot scenes are thrillingly told.

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[1] Juanita McDougald, Associate, Division of Instructional Service of the State Department of Public Instruction.

[2] Juliana and her husband, Jacques Busbee, are well known because of their work at Jugtown, North Carolina's original source of colonial craft pottery.

[3] Program, 1937, Juanita McDougald (Mrs. William T. Melchior, Syracuse, New York).

[4] W. D. Weatherford, director, Robert E. Lee Hall, has contributed space and advice to this undertaking.

[5] The Jugtown story has been fascinatingly told by Juliana R. Busbee in *The Bulletin*, **16** [10] 415 (1937). "Jugtown" is the copyrighted name of the pottery established and operated by Jacques Busbee at Steeds, North Carolina. This is the one and only pottery with the legal right to use the name of "Jugtown."

The term "jugtown" as used in this article describes the potteries which (1) employ the "tub and mule" method of preparing the clay, (2) make ware exclusively by throwing, and (3) fire their ware in ground-hog kilns.

The Present-Day Potters of North Carolina

In a book by Allen H. Eaton entitled Handicrafts of the Southern Highlands, there are excellent photographs and word pictures of jugtown potters, their crude equipment, their "ground-hog" kilns, and the utilitarian ware made by them. Eaton hints of the emergence of the jugtown potters from producers and vendors of utility ware to producers of artware. He missed the new influence that is found in the Busbee and Hilton "jugtown artware" and in the Stephen porcelain artware. These three potteries are not equipped for or organized to engage in commercial artware production, as is the Royal Crown Pottery at Merry Oaks, the Cole Pottery near Smithfield, and the North State Pottery at Sanford. The Busbees, the Hiltons, and Stephen are craft potters in that all of their ware is "thrown," in contrast to ware jiggered or cast in molds. The purpose of this present writing on the potteries of North Carolina is to analyze the influences which set the stars for these three potteries and which made them different from the jugtowns of the past and the "commercial" potteries of the present.

The Omar Khayyám Pottery

What a thrill it was to find a little weather-beaten jugtown pottery bearing the name "Omar Khayyám Pottery" in large letters. Who could its founder be? Thus was started the search for and of Oscar Louis Bachelder. A recording of all of the interesting findings would be futile, so contradictory are the traditions of which Bachelder himself was the author.

A brief statement and a photograph of Oscar Louis Bachelder is given by Allen H. Eaton. W. B. Stephen, of the Pisgah Forest Pottery, had a photograph and a very complimentary memory of Bachelder. But these only excited the urge to know the "who, what, and why" of Bachelder's background and of his potting in Luther, North Carolina. The name he gave to his humble pot shop, Omar Khayyám, evidenced much more than either Eaton or Stephen told. This was not a "pie-plate sail" in quest of information, as Mrs. Busbee relates of her husband's experience,[6] but it was Mrs. Busbee, nevertheless, who provided the navigating chart. Here, in part, is a letter from Mrs. Busbee dated November 9, 1941:

In 1914, I was Chairman of Art in the Raleigh Woman's Club. About that time, I saw a notice in an Asheville paper that a potter in Luther was doing nice crocks, churns, and flowerpots. We were trying to locate all the potters and weavers in the State, so I went up to Asheville to see what kind of work this potter was doing. I took the train one cold morning in March, 1914, and arrived at Candler. Here I was first introduced to O. L. Bachelder. I spent the day with him, returning at night to Asheville; I returned the next day and the next. At that time, he had made no attempt to do any kind of pottery save stoneware.

For those three days, I stood by the wheel and had him do for me certain things I wanted, a tea set, a lid pitcher, some mugs and plates, a salad bowl, some flower bowls, and some little jam pots that I wanted the Home Demonstration Clubs to use as official containers. He was interested and promised to supply duplicate things if anyone wanted them. Seeing a copy of *Omar Khayyám* on his table, I suggested that as his trade name, and I did his monogram which he used as his trademark. I had an interesting three days. He was a good cook, made all his own bread, baked beans, etc.

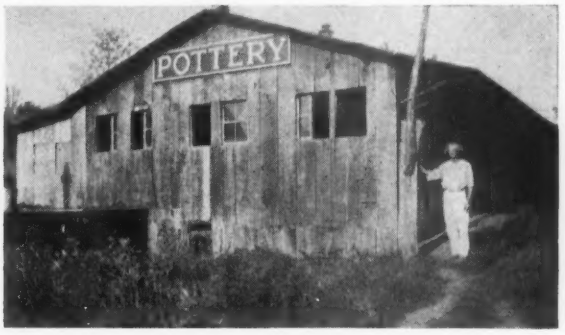
That spring, I was elected State Chairman of Art in the North Carolina Federated Club. I saw to it that Mr. Bachelder's work was exhibited all over our State. I sent the things he had done for me from the ocean to the extreme west part of the State so that he quickly became known in North Carolina. We gave him premiums at our State Fair.

I have now the teapot, a pitcher, several plates and mugs, three bowls, two jam pots, and a vase which were made for me by Mr. Bachelder.

I wrote an article for a state magazine, called *Everywoman's Magazine*, October 16, 1916, about North Carolina baskets and pottery. It is illustrated; one of the pictures is a collection of the things done for me by Mr. Bachelder.

(signed) JULIANA R. BUSBEE

Front view of Omar Khayyám Pottery



Omar Khayyám Pottery viewed from the east

On November 20, 1941, W. B. Stephen wrote as follows:

Mr. Bachelder was a stoneware man when I came to North Carolina in May, 1913. He carried churns and crocks around in the mountains and sold them to farmers and stores. Then Mrs. Busbee got him to make some ware for her, which was the beginning of his art career. He glazed only with Albany slip. The best pieces he fired several times with repeated thin Albany, giving an iridescent effect.

The quest for exact information concerning Bachelder led to contacts with Mrs. Grace Canfield of Woodstock, Vermont; William Soini, 3906 Eighth Avenue, Brooklyn, New York; Paul St. Gaudens, Cornish, New Hampshire; Myrtle M. French, Chicago, Illinois; and Converse Harwell, Fairhope, Alabama. Newspaper and magazine articles concerning Mr. Bachelder, as well as letters written by him, were read to find the background of this unusually clever potter and man who, with the Busbees, profoundly influenced the upswing from "jugtown utility" to "jugtown artcraft ware" in North Carolina.

[6] *Loc. cit.*, p. 415.

Mr. Bachelder's father was a stoneware potter who migrated from Vermont to Wisconsin and Minnesota. His forebears were potters in England. Mr. Bachelder's mother was Hannah Tipley Bothwell. Both parents were of well-educated, cultured families. His mother was a writer and a lecturer of no mean ability.

Oscar was born in July, 1850, and became an itinerant stoneware potter early in his teens and was a "thrower" of stoneware until 1900. It was at this time that stoneware began to be jiggered, rather than hand turned. It was the advent of the machine, as well as his advancing years, that forced Mr. Bachelder to find a use for his skill somewhere other than in commercial stoneware plants. It is said that he tried for a while to work at Rookwood Pottery in Cincinnati, Ohio, but that they could not give him full-time employment as a pottery thrower. He did, however, experience at Rookwood the making of artware.

He went to Luther Station (P.O. Candler), North Carolina, in 1911, when he was sixty-one. It was in 1914 that Mrs. Busbee visited him, and in 1916 he bought his shop.

Logan Medal

In 1919, Mr. Bachelder received the Logan Medal and a $100 prize for a "collection of pottery" in an applied art exhibition at the Art Institute of Chicago.

One of these vases was a small thrown piece which had been glazed with Albany slip and fired. During the firing, the piece had been knocked over and had rolled in the wood ashes in his ground-hog kiln when he drew one of his test rings. The piece stood about the shop for some time until he became curious to see what would happen if it were glazed again. He did glaze it again and later sent it to the exhibition, where he received a prize.

Bachelder's Pupils

In 1920, W. B. Stephen worked with Mr. Bachelder. In 1923 and again in 1934, Paul St. Gaudens spent several weeks as a pupil with Bachelder. In the winters of 1925, 1926, and 1927 and in 1930 and 1931, William Soini spent several weeks with Bachelder practicing the art of making pottery.

Converse Harwell was also one of his pupils, first in 1925 and at many week-ends in the years following.

A Week in Boston

From 1925 to 1931, the Women's Educational and Industrial Union of Boston held a series of annual Exhibitions of Craftsmen-at-Work, and it was in 1927 that the group of people from the South, of which Oscar Bachelder was one, attended. Before the Exhibition, Miss Browne made a trip to the South and selected personally a small number

An exhibit of Bachelder's ware
Interior of Omar Khayyám Pottery, Candler, North Carolina

of craftsmen whose work she felt was of special merit and interest to the general public. She approached Henry Ford in the matter, knowing of his interest in all craftwork, and he offered to subsidize the expenses of such a group.

The Exhibition was held from March 15 to 19, 1927, in Horticultural Hall in Boston. As these exhibits were all made up of "working groups," visitors were able to see the process whereby an article was made from start to finish. Mr. Bachelder was a most popular demonstrator, and there was always a large crowd of observers around his booth.

Death of Bachelder

Oscar Louis Bachelder died of cancer on June 25, 1935, at the age of eighty-five, after a quarter of a century of lifting the standard of jugtown potting in North Carolina.

Oscar Louis Bachelder

Testimony of Ceramic Artists

Paul St. Gaudens says of Mr. Bachelder:

Bachelder's pottery had a "timeless" quality. His vases would be superior examples of throwing and glazing in any age or country. It is "potter's pottery," as there are not too many people with enough feeling for the craft to appreciate the skill of the wheel work and the rich beauty of the dark glazes.

He glazed entirely with Albany slip, getting an amazing range of fine colors with it, from dark maroon through rich browns to raven's-wing black and steely gray. He obtained unusual effects by sprinkling the wet slip with ashes or, less frequently, with cobalt or manganese. He fired in a huge "ground-hog"–type kiln,[7] with the firebox at one end and the stack at the other. He fired it with native pine for 72 hours or more, getting heats of from cones 7 or 8 at the rear of the kiln to cone 12 at the front of the kiln. He knew exactly where to set a vase to get the effect that he wanted; he fired the commercial ware and art pieces together.

He was a wonderful thrower. He always finished a piece on the wheel, that is, when he lifted it off the wheel, it was finished except for the smoothing out of any lifter marks. He could fill out the belly of a large vase without losing any height whatsoever. He could even make a finishing draft with a rib from top to bottom of a bellied vase without losing height. He never threw a "clockweight," in fact, his throwing was just about perfect. He also had a good eye for line. The shapes had fine character; nothing "fancy"—just excellent honest craftsmanship, like the finer of the early Japanese shapes.

Anyone with "Old Bach's" strength and individuality of character was almost automatically prejudiced and crotchety. He was past seventy years when I first knew him. He liked me and we were friends. I never aroused his black Irish temper. He was a wiry active man, somewhat stooped, not tall, with huge strong hands. He had snapping black eyes. He was interested in everything. I doubt if he had much, if any, schooling, but he read avidly and understood what he read. He had arguments and rows with his neighbors, but they still respected him and some admired him. He was strictly honest and demanded honesty in others. The mountaineers also respected his courage and his flaming wrath when he felt he was being imposed upon.

I have fine memories of Saturday trips to Asheville with him. We would get lunch at his favorite little "home-cooking" cafeteria, indulge in a box of Rameses cigarettes (the only brand he could taste or enjoy after his clay pipe and natural leaf tobacco), and go to a movie. He liked movies and was critical of them. Sloppy sentimentalism didn't go down with "Old Bach" at all. Sunday afternoons we would sit out on the little porch with Webb Miller, who was a chum of Bach's; discuss the affairs of the world; and have one glass of blackberry wine from a small jug. He was a unique and unforgettable character as well as a fine potter.

W. B. Stephen of the Pisgah Forest Pottery states:

Bachelder was buried in a high location alone. He did not want to be buried in a graveyard. He had no minister, but a woman whom he had befriended read the Sermon on the Mount, the only part of the Scripture in which he took any stock. He was very kind to people in trouble, the sick, and animals.

He was a very fine turner on the wheel, being particular in form and finish. He made fine blacks with Albany slip. He made a few blacks with yellow overflow that were especially fine.

"For, in the Market-place, one Dusk of Day,
I watch'd the Potter thumping his wet Clay:
And with its all-obliterated Tongue
It murmur'd—'Gently, Brother, gently, pray!'

"And strange to tell, among the Earthen Lot
Some could articulate, while others not:
And suddenly one more impatient cried—
'Who is the Potter, pray, and who the Pot?'

"Then said another—'Surely not in vain
'My substance from the common Earth was ta'en,
'That He who subtly wrought me into Shape
'Should stamp me back to common Earth again.'"

—*Rubáiyát of Omar Khayyám*
(Translated by Edward Fitzgerald)

The E. A. Hilton Pottery

Ernest A. Hilton was born September 20, 1879, ten miles south of Hickory, North Carolina. His mother died when he was seven years old. He began to work in the pottery in these early years and was actually throwing one-quart jars on the wheel when he was twelve years old. He stayed with his father until he was twenty-one years of age.

His father made utilitarian crocks, churns, etc., until the household acceptance of these decreased, owing to the competition of jiggered stoneware. It then became necessary to make jugtown artware or to stop potting.

Ernest married when he was twenty-four. He then went to work for Tom H. Phillips of the Oak Grove Pottery, where he remained for six years. It was at this Pottery

[7] Bachelder, in his later years, used a round downdraft kiln similar to the one built by W. B. Stephen after the design given by Taxile Doat in his treatise entitled Grand Feu Ceramics (S. E. Robineau translation, page 109). In this kiln he fired uniformly to cone 10, using kindling wood.

that Ernest began making what he called "fancy ware," i.e., flowerpots, vases, etc., as a side issue.

In 1906, he left the Phillips Pottery and went into the pottery business in Iredell County with his brother-in-law, Seth Richey, and his cousin, George Hilton. In 1908, he leased an old shop south of Hickory from his brother to make "fancy ware" altogether, and he continued production here for fourteen years.

In 1922, Ernest bought a location four miles east of Hickory, and in partnership with his brothers, Shufford and Claud, he began to make "fancy" jugtown pottery. He bought out his brothers' interest for $380 in 1934, and, in 1935, he moved to his present location four miles west of Marion.

Ernest A. Hilton

All jugtown potters use what is known as the ground-hog kiln, a wood-burning furnace in which the flame passes over a broad platform to a chimney in the rear. The ware is set on this platform where it is unprotected from flame, dust, and roof drippings. All of the Hilton ware is made today in such a kiln.

In the olden days, Ernest's father, unlike the usual jugtown potters, did not use Albany slip alone, but he ground glass and mixed it with cinders from the Reinhard furnace in Lincoln County. Ernest Hilton is now using for a glaze ground-up Coca Cola bottles, mixed with clay, which produce a peculiar and attractive effect. He has been using such a glaze on his "fancy ware" since 1905.

Since he has been in his present location west of Marion, he has made only the so-called "fancy ware." In 1935, shortly after moving to Marion, his wife began painting his ware with underglazed slip; she used the familiar dogwood decoration first and most often. The white dogwood blossom with its black tip is in raised slip decoration. Lately, she has been painting flowers in the flat and in different colors; she has also painted quite accurately the birds and scenes of the district, using not only white slip but several colors. Her underglaze painting is accurate and beautifully executed.

Sculpture and underglaze paintings by Mrs. Hilton

Mrs. Hilton began making figurines in 1937, and she has shown in these figurines the characteristic mountain folk at play and at work. Her most attractive and noteworthy modeling in clay is the Créche group of figurines which depicts the birth of Christ and the homage paid by the Kings.

The Hiltons have five children, namely, Ernestine (1904), the wife of Mr. Sigman, who is principal of the high school at Hickory; Hunter (1910), a bookkeeper living in Hickory; Mozell (1913), who lives at home and is not at all interested in pottery; Mildred (1915), Mrs. Henlry, a widow, who lives at home (Mildred makes figurines, but does not paint); and Lera Dare (1919), Mrs. Whitson, who lives at home. A ceramic artist of considerable native gift, Mrs. Whitson paints flowers in the flat.

Ernestine, the oldest, has made some fine artistic ware, all of which has been fired by her father in the ground-hog kiln.

Ernest Hilton is the only member of the family who throws on the wheel. He makes all of the ware, and his wife and youngest daughter do all of the decorating.

Mr. Hilton believes that he is not going to make all of the pottery wanted in the world and that what he does not make some other potter certainly will. He therefore lives a life of comparative leisure, firing his kiln once in about fifteen days.

The Pisgah Forest Pottery

Vases by Walter B. Stephen, the Covered Wagon (far left) and Buffalo Hunt (far right) are in porcelain paste cameo

The stories of the Busbees' Jugtown, of Hilton's, and of Bachelder's potteries have been told. The fundamental art training and practices of the Busbees directed toward revitalizing the jugtown craft, the influence of Bachelder in applying his skill and fine artistic concepts, and the re-

creation of the German Moravian pottery art of their ancestors by the Hiltons in jugtown craftware form a mosaic picture of applied education, artistic manual skill, and of high ideals. The Busbees, Bachelder, and Hilton have made large and permanent contributions to the pottery craft of North Carolina. The fine art of the Busbees and the exquisite potting skill of Bachelder were without the jugtown background, whereas Hilton is the product of generations of jugtown pottery training. Hilton reflects the impact of the craft practices of the Busbees and of Bachelder.

Walter B. Stephen, Pisgah Forest Pottery

The influence of Walter B. Stephen on the craft pottery of North Carolina is quite different and distinct. He is not a native of the South, he is not a potter by lineage, and he does not produce jugtown pottery, yet he has a prominent place in that mosaic of pottery artcraft of North Carolina. His museum of artware in mat, crystalline, and rare glaze colors of his own production, and his library of well-thumbed books of literature and ceramic technology prove that Stephen is a student with the ability to use his knowledge.

Walter B. Stephen was born October 3, 1876, in Clinton, Iowa. His father, Andrew Stephen, was a mason and stone cutter. When he was ten years old, his family moved to Rushville, Nebraska, in the days of Buffalo Bill and of tar and feathering. They lived in a sod house which they fortified when the Sioux Indians were on the warpath in 1891.

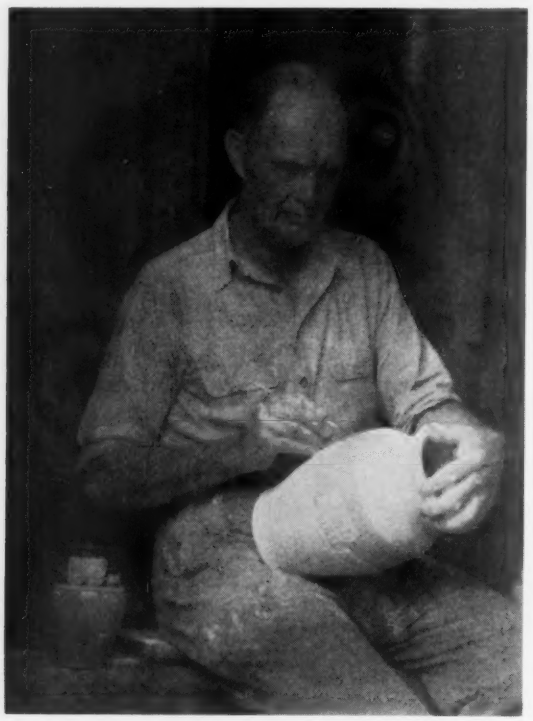
Walter B. Stephen, Pisgah Forest Pottery

Under these primitive and exciting conditions, Stephen's mother continued drawing pictures for the Children's Page of the *Youth's Companion*.

Pisgah Forest Pottery

When Walter was twenty years of age (1896), the family moved to western Tennessee. Here he and his father engaged in masonry construction. It was not until 1901 that he and his mother became interested in clays and in pottery making. A clay of unusual color was found when they were digging a well. From this clay, they whittled small figures and boxes which they fired in a small kiln which Walter had built.

A Memphis woman asked Walter and his mother to make some vases for her. Undaunted by their lack of experience and knowledge, they proceeded with the task of filling this order. Walter constructed a kick wheel. His father had been told by a potter in Memphis that glazes were made of feldspar, so they glazed their vases with a mixture of feldspar and chrome green stain.



Walter B. Stephen, Pisgah Forest Pottery

Walter writes as follows:

I soon found out that feldspar did not melt like butter. I was discouraged, but the little mother stood over me and made me melt it though it took four firings to do it, and I had to turn it upside down to get the bottom end. We later made some good vases with the same clay and the same green glaze. That was the best experience I ever had in the pottery business.

Walter and his mother continued to make craft pottery. Mrs. Stephen used her artistic drawing ability in the pâte-sur-pâte decorations which Walter has since so skillfully developed.

In 1910, when Walter was thirty-four years old, both of his parents passed away. For two years, he traveled widely throughout the United States. He went to North Carolina in May, 1913, with the ambition to make the line of pottery which he and his mother had developed. C. P. Ryman of Skyland saw his pottery and offered to build a shop and erect a kiln. For three years, until 1916, they operated this pottery in joint partnership. Walter withdrew from partnership with Mr. Ryman in 1916. That same year, Walter purchased the land and built the small home in which he lives today. From 1916 to 1920, Walter built chimneys and small constructions. In 1920, he again began to make pottery. Having heard of Oscar L. Bachelder, he visited him, and thus began a friendship that continued until Bachelder passed away. In 1923, Walter moved to West Asheville where he could find employment in construction enterprises and continue experimenting in pottery making. Three years later (when Walter was fifty years old), he moved back to his place on Brevard Road, Route 191, between West Asheville and Hendersonville.

Twenty-five years before Walter came back to his home on Brevard Road near Skyland to operate a pottery, he and his mother had hand-painted cameo decorations on vases. It was his cameo-decorated pottery which interested C. P. Ryman to enter the partnership with him, Ryman furnishing the money with which to build the pottery and Walter furnishing the knowledge and skill with which to make the cameo-decorated vases.

When, in 1926, Walter had his own pottery, he developed his high-fire (cone 10) vitrified ware. All of his vases are thrown on a wheel in true craft style.

In July, 1937, he took into partnership two apprentices, namely, Grady Ledbetter and William Rhodes.

Thus is recited the "statistical story" of Walter B. Stephen, a potter extraordinary. After seeing him paint freehand (pâte-sur-pâte) cameo pictures of a buffalo hunt or a covered wagon caravan on pottery with accuracy in detail, one realizes that here is a ceramic artist. After seeing his unique five- by six-foot round downdraft kiln in which he fires with even heat distribution to cone 10 in twelve hours with kindling wood, one realizes that here is a ceramic engineer. After seeing his control in the production of mat, crystalline, and craquelé glazes and in the production of rare colors, all on dense porcelain, one realizes that here is a versatile ceramist. All of his ware is hand thrown.

Busbee, Hilton, and Stephen are craft potters of exceptional abilities, each very different. Oscar Louis Bachelder's par-excellent craftmanship inspired them and continues to inspire in true Omar Khayyám tradition.

What of the Future?

Success in ceramic artcraft depends upon several material and personal fundamentals, none of them costly. The essential material requirements are (1) a clay or body mixture that will become impervious to water at the firing heat-treatment employed and which can readily be worked into a homogeneous paste, (2) suitable glaze or glazes and colors in harmony with the type of ware adopted, (3) kilns of relatively small and varying capacities to meet the production demands, and (4) a sturdy potter's wheel. It is idle to continue with ground-hog kilns when more efficient kilns have been developed which can be built by anyone who can build a ground-hog kiln.

Artistic ability, vision, courage, persistency, and patience are the personal fundamentals needed for success in ceramic artcraft. The ware must be carefully and pleas-

ingly shaped and decorated. A successful craft potter should adopt a single type of ware, such as the Pennsylvania German ware, rather than produce types promiscuously. A craft potter must enthusiastically believe that his ware (not necessarily of his own origination) is the best of its kind, and he must make himself and his ware known to the purchasing public. Above all, the craft potter should avoid copying the ware made in mass-production shops. Investments in casting and jiggering molds and in jiggering machines are wastages of money. Such equipment does not produce the craftware wanted by the trade.

Using a single clay body and Albany slip glaze, Bachelder, with unusual skill, produced vases which won exhibition awards and which won the acclaim of the most critical of ceramic artists. He invested very little in materials and equipment. He kept to a single type of artware. His largest and most profitable investments were his skill, his patience, and his courage.

ROSS COFFIN PURDY: CERAMIC LEADER*

Honorary Membership Ceremony, The American Ceramic Society General Session, Cincinnati, Ohio, Forty-Fourth Annual Meeting, April 20, 1942

PRESIDENT J. T. LITTLETON: The Fellows of The American Ceramic Society have asked for time in this morning's program to present a recommendation. Alexander Silverman will furnish the details.

ALEXANDER SILVERMAN: The Committee on Honorary Membership of the Fellows (G. A. Bole, M. E. Holmes, L. Navias, and A. Silverman, *Chairman*) yesterday recommended the election of Ross Coffin Purdy to Honorary Membership. The Fellows, after approving the recommendation, in turn asked the Trustees to approve it. The Trustees were in full accord. It is now my pleasure to present for Honorary Membership in The American Ceramic Society Ross Coffin Purdy, Secretary of The Society, concerning whom I should like to present a biographical sketch which I have prepared.

Through the courtesy of members of The Society who have known Dr. Purdy intimately, this account of his life and contributions has been made possible. Especially valuable has been the information obtained from M. E. Holmes and V. V. Kelsey.

Ross Coffin Purdy was born March 3, 1875, in Jasper, New York. Possibly the name of his birthplace, also applicable to a variety of quartz, was an omen of the field in which he would ultimately excell. He was the son of Andrew and Mary Elizabeth (Coffin) Purdy. His father began his career as a practicing physician, but later forsook medicine for the ministry, associating himself with the Methodist Episcopal Church. This was the wholesome environment of Ross's boyhood. He attended public schools in Lawrenceville, Pennsylvania, and in Victor, North Tonawanda, and Buffalo, New York. From the high school in Buffalo, he entered Syracuse University in 1894. In 1896, he learned of the opening of the Department of Ceramics at Ohio State University, the first to offer a four-year course in ceramics. He transferred from Syracuse. Six weeks after he entered Ohio State University and matriculated in the Department of Ceramics, his father died, and it was necessary to change from the four-year course to a two-year industrial course. For this he received a certificate of graduation in 1898, but he continued his studies at Ohio State University on a competitive scholarship to the spring of 1899. Then he went to the Mosaic Tile Company of Zanesville, Ohio, as chemist and assistant superintendent for two years and next to the Roseville Pottery as chemist and foreman in the glazing and firing departments for one year. The year 1901 found him with the Buckeye Pottery Company of Macomb, Illinois, producing stoneware specialties. There he developed various colored glazes and assisted in sales.

Ross Coffin Purdy

In 1902, General Edward Orton, Jr., Director of the Department of Ceramic Engineering at Ohio State University, invited Ross to become instructor. He retained this position until the fall of 1905 when the University of Illinois made him assistant professor of ceramics. This appointment marked the beginning of ceramic engineering

* Publication by authorization of the Publications Committee, John D. Sullivan, *Chairman*.

at Illinois, where he organized and equipped the Department of Ceramics. During his first two years there he also served as ceramist with the Illinois Geological Survey, where he engaged in research and published a number of bulletins on fritted and crystalline glazes and on the pyrochemical and physical behavior of clays.

In 1907, Ross returned to Ohio State University as assistant professor of clayworking and ceramics. The following year, he became assistant professor of ceramic engineering, and in 1911 he was appointed full professor. In 1908, he had completed the full curriculum requirements, and Ohio State University conferred on him the degree of ceramic engineer. During this period, he was engaged in researches on glazes and whiteware compositions. He taught analytical chemistry, and for two years, while General Orton was on leave, he served as acting head of the Department.

Many of his students, to whom he was a magnetic and inspiring force, have testified to his unusual ability as a teacher of ceramics. His interest in this field, moreover, has never flagged, and his frequent editorials, which give constructive and uncompromising suggestions to improve the curricula offered by the ceramic schools, display his intense interest which has continued since the end of his teaching days.

In 1912, he resigned his professorship to become director of laboratory research for the Norton Company of Worcester, Massachusetts, manufacturers of abrasives. There he developed plant control methods and conducted a course to train men for technical and sales positions with the Company. He was interested not only in product development but also in sales promotion. His improvement in methods of firing kilns assured uniform heat distribution, and he experimented with various fuels, both solid and liquid. The size of the kilns was increased and a tunnel kiln was installed. On leaving the Norton Company in 1919, he engaged in private consultation as ceramic engineer.

The American Ceramic Society was founded in 1898, and incorporated in 1899 under the direction of General Edward Orton, Jr. For nineteen years it functioned as an academic organization, publishing annual *Transactions* and holding an Annual Meeting in the winter or spring and a plant excursion in the fall. It was Ross Purdy's idea that industrialists as well as educators and research men should be cared for by The Society. Already in 1918, he was responsible for the creation of Industrial Divisions with their own officers and committees and with separate programs at Annual Meetings. Local Sections were created in various parts of the country, and Student Branches were developed in a number of universities. During the early part of this organization, Charles F. Binns of Alfred University was Secretary, and the editors of *The Journal* in succession were George H. Brown of Rutgers University; Homer F. Staley, then with the National Bureau of Standards in Washington, D. C.; and E. W. Washburn of Illinois. In1922, Ross Purdy was elected General Secretary of The American Ceramic Society with headquarters in Columbus, Ohio, and became full-time Editor of *The Journal, Ceramic Abstracts*, and *The Bulletin*. The Society now has seven Industrial Divisions, nine Local Sections, and eight Student Branches. Although the Divisions have separate officers and committees, they hold sessions simultaneously at the Annual Meetings and really serve as a federation of ceramic industrial, art, science, and education groups working together in full cooperation. It was Secretary Purdy's foresight and persistence which created these Divisions and which prevented the separation of groups from The Society to organize new societies. When institutes of various kinds came into fashion, The American Ceramic Society created its own Institute of Ceramic Engineers instead of suffering the loss of this group to a separate organization as has happened to so many other technical societies.

Ross Purdy has been instrumental not only in building up The American Ceramic Society at home, but he has insured contacts with other societies here and abroad and with industrial groups such as manufacturers or trade groups.

In 1928, he personally conducted a ceramic tour of Europe. A group of about seventy members of The Society, in some cases with members of their families, virtually chartered a small boat on whose cruise Ross Purdy's magnetic influence in social welding was in evidence. There was never a dull moment on the trip. When the party landed in France, there were technical sessions in Paris and trips to various plants there and elsewhere in France. The party journeyed on to Czechoslovakia and Switzerland, Germany, and Holland, and finally to England. There was royal entertainment and a grand reception at every place they visited. Secretary Purdy was known, and the group which he sponsored was welcome. His friendly spirit in meeting leaders and notables in foreign countries immediately broke down the reserve which might have existed for individuals, and by the time a banquet was held in a city Ross was already able to call most of the foreign participants by their first names.

Then, as the result of The Society's five-week tour in Europe, a group of British ceramists visited America in the spring of 1929, under the leadership of President Gardner of the British Ceramic Society. With them was the late J. W. Mellor, famous British chemist and ceramist. Secretary Purdy planned a nationwide tour, appointed regional chairmen throughout the country, and gave those British guests receptions and experiences which they can never forget.

The fruits of Secretary Purdy's interests and activities in The American Ceramic Society are too well known to the membership to require further elaboration at the present time. Many of the members may not know, however, that it was through the influence of Ross Purdy that federal bureaus developed an interest in ceramics. While James A. Holmes was Director of the United States Bureau of Mines, federal and state surveys were begun on ceramic materials, and Dr. Holmes included a Division of Ceramics, which was established at Ohio State University. Samuel W. Stratton also created a Ceramic Division in the National Bureau of Standards, then located in Pittsburgh, Pennsylvania. There is no doubt that Ross Purdy actively promoted the movement which led to the establishment of the government ceramic divisions.

In addition to his membership in The American Ceramic Society (Fellow), Ross Coffin Purdy is affiliated with the American Society for Testing Materials and the American

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PAID MEMBERSHIP RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Circulation
	Personal	Corporation				
December 21, 1941	2029	257	37	609	220	3152
January 21, 1942	2043	254	38	600	220	3155
February 21, 1942	2083	255	34	605	220	3197
March 21, 1942	1780	240	49	355	220	2644
April 21, 1942	1836	244	45	361	220	2706
May 21, 1942	1883	251	37	371	220	2762

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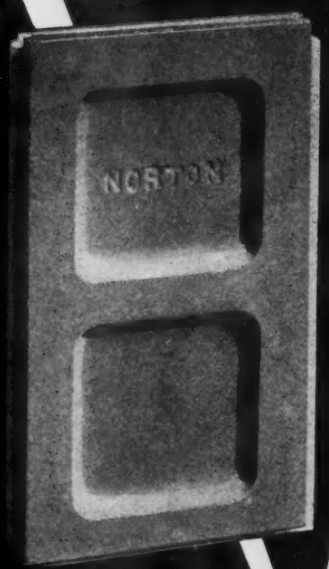

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BRUTSCHE, J. H., Bauer Pottery Co., Box 6, Station A, Atlanta, Ga.; president.
DERINGER, W. A., 3045 N. 39th St., Milwaukee, Wis.; ceramic engineer, A. O. Smith Corp.
DOUGLASS, WILLIAM E., 920 Charles St., Wellsburg, W. Va.; manager, Panhandle Division, Monongahela West Penn Public Service Co.
*FOLEY, FENWICK D., Foley Pottery, Ltd., St. John, N. B., Canada; manager.
GONDER, LAWTON, Gonder Ceramic Arts, Inc., Zanesville, Ohio; president and general manager.
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GROSSMAN, R. B., 810 S. Flower St., Los Angeles, Calif.; Southern California Gas Co.
GUSTIN, JUD A., 2140 E. 82d St., Chicago, Ill.; research engineer, Atlas Lumnite Cement Co., Buffington, Ind.
MOTSCH, FRED R., Foster-Forbes Glass Co., Marion, Ind.
OLPIN, ALBERT R., 2040 Tremont Rd., Columbus, Ohio; research director, Ohio State University Research Foundation.
PEARCE, CHARLES S., Porcelain Enamel Institute, 919 New York Ave., N. W., Washington, D. C.
*SLAUGHTER, JAMES A., Box 311, Crystal City, Mo.; assistant superintendent, Tank Department, Pittsburgh Plate Glass Co.
*TAYLOR, CHARLES H., 2228 Waller St., Portsmouth, Ohio; vice-president, Charles Taylor Sons Co.
TORGESON, DALE R., 102 W. Bellecrest Ave., Pittsburgh (10), Pa.; chemical engineer, Harbison-Walker Refractories Co.
*WATKINS, JOEL H., 312 Raleigh Bldg., Raleigh, N. C.; consulting geologist, Pratt, Lassiter & Watkins.
WILLMORE, TRACY A., JR., 557 Carolina St., Apt. 3, Gary, Ind.; ceramic chemist, Atlas Lumnite Cement Co.

* Indicates former member of The Society rejoining.

Student

Pennsylvania State College: CHARLES L. MELOY.

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Office	2		

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W. E. Cramer	1	Lane Mitchell	1
W. E. Emerson	1	Heinrich Ries	1
Edmund Jones, Jr.	1	C. L. Thompson	1
Office	8		

Student

Office	1
Grand Total	**23**

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GENTRY, RAYMOND, 107 E. Cummings, Henryetta, Okla. (Sand Springs, Okla.)
HALL, JAMES L., American Manganese Steel Div., Chicago Heights, Ill. (Mahwah, N. J.)
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JACKSON, ARTHUR W., Harbison-Walker Refractories Co., Box 311, Fairfield, Ala. (Athens, Tex.)
JONES, EDMUND, JR., 8153 Evans St., Chicago, Ill. (Detroit, Mich.)
KOENIG, JOHN H., 3007 Neil Ave., Columbus, Ohio (East Liverpool, Ohio)
MERRIAM, JACK G., in care of E. M. Dubois, Route 1, Lewiston, N. Y. (Gaithersburg, Md.)
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RANDALL, RUTH H., 110 Lynbrook Circle, DeWitt, N. Y. (Syracuse, N. Y.)
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* Address in parentheses is former address.

Association for the Advancement of Science (Fellow). He is an Honorary Member of the Canadian Ceramic Society and of the Czechoslovak Ceramic Society, and an Honorary Fellow of the Society of Glass Technology of England. He is also an Honorary Life Member of the Ohio Ceramic Industries Association. On the occasion of the granting of the honorary degree of Doctor of Science by Alfred University in 1936, M. E. Holmes, Dean of the New York State College of Ceramics, commented as follows:

"Since the passing of the great founders of the American ceramic profession, the ceramic world has been turning more and more for leadership to the distinguished candidate, Ross Coffin Purdy, whom I am presenting at this time for an honorary degree . . . . Alfred University is honored today in this privilege of recognizing before the ceramic world his services to the ceramic cause, distinguished as they are by devotion, unselfishness, and effectiveness . . . . My time permits only brief reference to the candidate's outstanding services and achievements which have contributed so prominently to the present high standard of ceramic education, ceramic manufacture, and ceramic science. He has given unstintingly a full life's measure of devoted service to the ceramic cause."

When the *Illini Ceramist* was dedicated to Ross Purdy in 1938 by the ceramic students of the University of Illinois, the preface read:

"Dedicated to Dr. Ross C. Purdy, First Instructor, Department of Ceramic Engineering, University of Illinois; General Secretary of The American Ceramic Society, Creator of Its Present Structure; Editor of the Publications of The American Ceramic Society; Author of Many Valuable Contributions to Ceramic Literature; A Leader in Research for the Industry."

In an article, "Twenty Years of a Great Man's Life," prepared by V. V. Kelsey in 1941, there is a description of Ross Purdy which is well worth repeating:

"Ross, in his personal appearance, is the embodiment of knightly and scholarly leadership; he is large of frame, broad-shouldered, and heavily built, with a commanding mien. His deep-set piercing eyes, ruddy complexion, striking Vandyke beard, and a quick alert habit give token of the salient phases of his character. He has the knack of power in accomplishing worth-while things. He has a nature not too phlegmatic and a temper which, when aroused, may become imperious. He is a noble rugged individualist. His qualities are mixed in a manner which make him outstanding. Those who know him recognize his fine qualities as coming from his noble responses to his place in life. His high sense of duty never permits him to falter in his complete faithfulness . . . . His high concept for his professional duties has led him to undertake and accomplish greater tasks than most individuals. In his relation with others, he is at home with all men, superiors, equals, and subordinates. He seems to get a quiet joy out of serving others."

On June 27, 1901, Ross Purdy married Myra J. Watts of Zanesville, Ohio. Her charm and hospitality are constantly in evidence at our meetings and in the home. There is no doubt that she has been of incalculable service to Ross throughout his career. In addition to the many "daughters" whom Ross adopts at our Meetings, he has three daughters of his own, Reliance Spencer Leiter, Constance Hopkins Cone, and Lois Brewster Turner. There are five grandchildren, of whom the grandparents are very proud.

Ross Coffin Purdy has served as chemist and ceramist, in research and in technical development, in design and in sales promotion. During World War I, he was active in many ways. At all times he has been a thoroughly loyal American, insisting on first consideration for Americans and their products. He has made America ceramic conscious. He has distinguished himself as General Secretary of The American Ceramic Society and has contributed greatly to its growth and usefulness.

The success which Ross Coffin Purdy has brought to The American Ceramic Society is a tribute to him and will continue under his guidance. Those whom he has inspired will perpetuate that tribute. In honoring Ross Coffin Purdy, The American Ceramic Society honors itself. (Applause.)

PRESIDENT J. T. LITTLETON: Dr. Purdy, if you will come to the platform, it will be my privilege and pleasure to declare you an Honorary Member of The American Ceramic Society and to present you with this diploma of Honorary Membership. (Lengthy applause.)

ALEXANDER SILVERMAN: And now, Mr. President, I have another pleasant duty. About fifty years ago, a young artist in a glassworks in Brierly, England, who had received many honors and who was not only a sculptor in glass but in bronze as well, a man who had taught himself the principles of science in addition to his art, left England because his superior officer had favored his own son in a factory position. This young man had studied under John Northwood, the famous glass sculptor. England's loss was America's gain, and Frederick Carder came to our shores. After exploratory trips in New York State, he finally came to a little town where, as he states, he got stuck in the mud. The town is known as Corning. After cleaning up and resting awhile, he looked about, and there he established his future. His long association with the Steuben Glass Works (now Corning Glass Works) is known to you. His biography has appeared in *The Bulletin*[1] and in numerous other publications. In addition to the honors which he received in England, he was the recipient of the Charles Fergus Binns Medal and is an Honorary Member of The American Ceramic Society.

Recently, this Dean of American Glass Men accomplished something in which few men have succeeded. He induced our Secretary to stand quietly at intervals during two days so that he could prepare a portrait-bust of him. Frederick Carder has not only prepared the bust but has presented it to The American Ceramic Society, with his compliments, to honor our Secretary. I now hand the bust over to you for preservation by The Society, expressing the hope that Ross Coffin Purdy will remain with us for many years in the company of this precious replica. (Applause.)

PRESIDENT J. T. LITTLETON: The Society is greatly honored and appreciates this memento of Frederick

[1] Alexander Silverman, "Frederick Carder, Artist and Glass Technologist," *Bull. Amer. Ceram. Soc.*, **18** [9] 343–49 (1939).

Bust of Ross C. Purdy made by Frederick Carder of the Corning Glass Works, Corning, N. Y.

Carder's work. I hope that in a short while the plaster model will be replaced by one in glass. I believe that this would be a particularly fitting material in which to perpetuate the memory of a pioneer in American ceramics in this Society. The bust will be placed in our executive offices in Columbus. (Lengthy applause.)

Publications of Ross Coffin Purdy

(1) "Stoneware Glazes," *Trans. Amer. Ceram. Soc.*, **4,** 61–78 (1902).

(2) "White Bristol Glazes," *ibid.*, **5,** 136–67 (1903).

(3) "Constitution of Chrome-Tin Pink (discussion)," *ibid.*, pp. 249–55.

(4) "Table for Quickly Obtaining the Silica Content of Glazes," *ibid.*, **6,** 260–68 (1904).

(5) "Limits of Variation in Biscuit Body Composition," *ibid.*, **7,** 79–88 (1905).

(6) "Floor-Tile Bodies Made from Clay," *ibid.*, pp. 95–114.

(7) "Calculation of the Comparative Fineness of Ground Materials by Means of a Surface Factor," *ibid.*, pp. 441–47.

(8) "Ceramic Education in Illinois," *ibid.*, **8,** 312–26 (1906).

(9) "Absorption Tests on Wisconsin Brick (discussion)," *ibid.*, **9,** 706–12 (1907).

(10) (With H. B. Fox) "Fritted Glazes; Variations of the Oxygen Ratio and the Silica-Boracic Acid Molecular Ratio," *ibid.*, pp. 95–186.

(11) (With J. F. Krehbiel) "Crystalline Glazes," *ibid.*, pp. 319–407.

(12) (With J. K. Moore) "Pyrochemical and Physical Behavior of Clays," *ibid.*, pp. 204–318.

(13) "Action of Different Forms of Calcium as a Flux in Porcelain Manufacture (discussion)," *ibid.*, **10,** 283 (1908).

(14) "Pyrophysical Behavior of Flint Fire Clays," *ibid.*, pp. 365–79.

(15) "Measuring Volume of Sealed Pores," *ibid.*, **11,** 60–64 (1909).

(16) "Mat Glazes (discussion)," *ibid.*, pp. 165–81.

(17) (With G. H. Brown) "Chromium-Tin Pinks," *ibid.*, pp. 228–61.

(18) "Extracts from Investigations Made by Students in the Department of Ceramic Engineering, Ohio State University," *ibid.*, **12,** 517–47 (1910); abstracted and edited by Dr. Purdy.

(19) "Fluxes and Fusion (Presidential Address)," *ibid.*, **13,** 75–85 (1911).

(20) "Range in Composition of Glazed Whiteware Bodies Made from Clay, Feldspar, and Flint," *ibid.*, pp. 86–96.

(21) "Seger's Rule for Correction of Glaze Defects by Changing the Body," *ibid.*, pp. 157–209.

(22) "Coefficient of Expansion Data on European Porcelain (discussion)," *ibid.*, pp. 418, 424, 429.

(23) "Relative Solubility of Clay and Flint in Feldspar," *ibid.*, pp. 479–88.

(24) "Porcelain Glazes," *ibid.*, pp. 550–84.

(25) "What Is Best Form of Magnetic Separator for Removing Iron from Slip? (Question Box)," *ibid.*, pp. 639–41.

(26) "What Is the Best Substance to Prevent Clay Slip from Settling in the Casting Process? What Is the Effect of This Substance on the Body in Firing?" *ibid.*, pp. 641–43

(27) (With A. P. Potts) "Influence of Clay, Feldspar, and Flint on the Coefficient of Expansion of Certain Whiteware Mixtures Biscuited at Cone 10," *ibid.*, pp. 431–68.

(28) "Glaze Composition on the Basis of 'Norms,' " *ibid.*, **14,** 95–112 (1912).

(29) "Influence of the Composition of the Stain in the Production of Red from Chrome-Tin Pink Stains," *ibid.*, pp. 172–79.

(30) "Production of Vitrified Black and Chocolate Floor Tile," *ibid.*, pp. 262–66.

(31) "Uselessness of Rational Analysis of Clays as a Means of Controlling Glaze Fit," *ibid.*, pp. 359–86.

(32) "Mat Glazes," *ibid.*, pp. 671–81.

(33) "Chemical Role of Boron in Glazes," *ibid.*, pp 731–39.

(34) "Coefficient of Expansion of Porcelain Body Mixtures," *ibid.*, **15,** 499–522 (1913).

(35) "Veritas Firing Disk," *ibid.*, **17,** 493–96 (1915).

(36) "Use of Zinc Oxide in Glazes for Semi- and Vitrified China Bodies," *ibid.*, pp. 520–26.

(37) "Superior Refractories" (editorial), *Jour. Amer. Ceram. Soc.*, **2,** [11] 864–69 (1919).

(38) (With M. F. Beecher) "Lightweight Refractory Brick," U. S. Pat. 1,345,632, July 6, 1920; *ibid.*, **3** [9] 766 (1920).

(39) "Benefits of Technical and Scientific Research," *Glass Worker*, **41,** 11 (1922).

(40) "Vocational Training in Ceramics," *Bull. Amer. Ceram. Soc.*, **4** [8] 372–74 (1925).

(41) "Influence of Chemistry on Ceramics," *Ind. Eng. Chem.*, **18,** 952 (1926).

(42) (With A. E. MacGee) "Some Physical Properties of Artificial Aluminous Abrasives," *Jour. Amer. Ceram. Soc.*, **11** [3] 192–203 (1928).

(43) "Westinghouse Salute to Ceramic Industries over KDKA," *Bull. Amer. Ceram. Soc.*, **9** [8] 241–42 (1930).

(44) "Industry's Need for Publicity," *Glass Industry*, **12,** 13 (1931).

(45) "Why American Pottery Is Not the Vogue in America," *Ceram. Age*, **18,** 220 (1931).

(46) "Effect of Temperature Treatment on Abrasives and Abrasive Products," *Jour. Amer. Ceram. Soc.*, **17** [2] 39–42 (1934).

(47) "What the Future Holds for Ceramic Graduates," *Bull. Amer. Ceram. Soc.*, **15** [7] 248–51 (1936).

(48) "Americans Are Leaders in Ceramics" (radio talk), *ibid.*, **17** [9] 382–83 (1938).

(49) "Creative Development Vision in Ceramic Industries," *ibid.*, **18** [3] 111–12 (1939).

In addition to the foregoing titles, Dr. Purdy has had issued, by the United States Patent Office, patents on abrasive subjects. He has also contributed valuable material to the ceramic literature in his editorials. Among these is a series on establishing a Ceramic Research Council to unite the various ceramic trade and technical organizations and a series on Ceramic Education with definite constructive recommendations.

ACTIVITIES OF THE SOCIETY

RICHARD J. LUND

Taking part in the General Sessions on War Emergency Problems at the Annual Meeting in Cincinnati, Richard J. Lund, chief of the Miscellaneous Minerals Branch of the War Production Board, Washington, D. C., presented an interesting summary of the investigations which are being carried out by WPB on the domestic minerals used in the ceramic industry.

Biography

Dr. Lund was born in Racine, Wis., in 1905. Spending most of his youth there, he attended grade school and high school in that city. He also spent one year at Asheville school, Asheville, N. C., following which he entered the University of Wisconsin, where he majored in geology. He received his B.A. degree in 1926 (thesis title, "Structural Features and Origin of the Ore in the Monmouth Zinc Mine in Southwest Wisconsin"); his M.A. in 1928 ("Underground Waters in Niagara Dolomite"); and his Ph.D. in 1930 ("Differentiation in the Cape Spencer Basaltic Flow in Nova Scotia"; based on detailed microscopic studies made from core samples available at the University of Wisconsin).

Richard J. Lund

Dr. Lund spent one year, from March, 1927, to February, 1928, in the oil fields of Oklahoma and Texas doing subsurface correlation work on well logs and actual scouting out in the producing and exploratory areas of western Texas.

From September, 1930, to December, 1933, he served as an instructor in geology at the University of Wisconsin, during which time he taught engineering geology, elementary economic geology, and assisted in teaching and lecturing and in laboratory work in general, structural, and economic geology.

From January, 1934, to May, 1935, Dr. Lund was employed in the Minerals Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., where he specialized in the foreign and domestic aspects of the petroleum industry for the first six or eight months. He then served as acting chief of the entire Division, handling all nonferrous metals and nonmetallic minerals. Although emphasis was placed on foreign supplies and markets, the domestic picture was also considered.

From June, 1935, to July, 1937, Dr. Lund worked in the Economics Branch of the U. S. Bureau of Mines, Washington, D. C., on a variety of subjects. For several years, he wrote chapters in the Year Book on minerals such as nickel, tungsten, molybdenum, cobalt, vanadium, radium, and uranium; he also wrote a general introductory chapter in the 1937 Year Book on the over-all picture of the mineral industry in 1936. He was also engaged in special studies on scrap metals, particularly iron and steel scrap, and initiated their yearly surveys on the consumption of scrap iron and steel which have been continued ever since. He also made some special studies on the cooperative work of the Bureau with the WPA on productivity studies on the nonferrous metals. During this work, he made an extensive two-month field trip throughout the country, including both eastern and western Canada. During this time, he visited most of the large mines and metallurgical plants of the mining industry, with the exception of the Arizona copper mines, which he covered later while working for the American Mining Congress.

From July, 1937, to July, 1940, Dr. Lund served as editor of the *Mining Congress Journal*, the monthly publication of the American Mining Congress, Washington, D. C. During this time, he kept in close contact with a broad segment of the mineral-producing industry in the United States in an endeavor to secure special articles on timely operating and economic subjects related to the mineral industry. Close associations with prominent officials in the mining industry were also gained through the numerous conventions held by the American Mining Congress each year. He was also closely associated with officials of companies manufacturing mining equipment and supplies.

Dr. Lund left the American Mining Congress to take a position under W. L. Batt and C. K. Leith in the Advisory Committee to the Council of National Defense, in August, 1940. Since this time, he has been engaged in war work constantly. He started out under Mr. Batt as assistant chief executive of the Other Mineral Products Group of the Mining and Mineral Products Division. In this position, he coordinated the work on all minerals except iron and steel, aluminum, magnesium, coal, and petroleum.

Since early in 1941, Dr. Lund has specialized in a large group of miscellaneous minerals, first as consultant, and, since July, 1941, as chief of the Miscellaneous Minerals Branch. The minerals this Branch now handles include industrial diamonds, diamond dies, jewel bearings, quartz

crystals, mercury, platinum, palladium, iridium, rhodium, ruthenium, osmium, selenium, tellurium, silver, gold, radium, uranium, monazite sand, abrasives, kyanite, topaz, talc, spodumene, lepidolite, bentonite, diatomaceous earth, feldspar, chalk, fuller's earth, kaolin, nonrefractory clays, and metals and nonmetals (not otherwise classified). The Branch is also responsible for the assembly of all of the available data on requirements and supplies, and whenever scarcities develop it must (1) investigate the possibilities of conservation and substitution, (2) draft and administer such conservation orders, and (3) allocate materials if supplies are still short after adequate conservational steps have been taken.

COMMITTEE ON RESEARCH REPORT

A. A. Wells, Homer Laughlin China Company, Newell, West Virginia, is Chairman of the Committee on Research of The American Ceramic Society. The Division representatives of this Committee for 1941–1942 are as follows: *Art*, H. F. Bopp; *Enamel*, F. W. C. Hutchison; *Glass*, N. W. Taylor, J. S. Gregorius, and H. R. Lillie; *Materials and Equipment*, E. W. Koenig; *Refractories*, D. W. Ross; *Structural Clay Products*, Frederick Heath, Jr.; and *White Wares*, J. H. Koenig.

Enamel

Much of the fundamental research and development in the enamel field, as in other branches of ceramics, has been on problems created by various war emergencies. In addition to new products needed in national defense, there exists or may exist shortages or limitations in certain materials which may require substitutions or changes in processing or in the type of product.

Reported researches on enamels have dealt largely with the fundamentals of opacity, reflectance, color, adherence, suspension, elimination of defects, and the improvement of strength and other physical properties. A number of studies are underway on ground-coat enamel adherence.*, (2)

A great deal of interest has been focused recently on the problem of getting equal or better coverage with white enamels at lighter application weights. A number of discussions on this subject have dealt with fine grinding as a means of obtaining increased covering power and also with problems of workability which are a result of fine grinding.

Several factors that should be considered if maximum reflectance is to be obtained from a given enamel are (1) that the increase in reflectance due to fine grinding depends partially on the frit used, and (2) that the effectiveness of an opacifier, kind, and amount of opacifier and clay used also affects reflectance.

It is current practice to grade white enamels by reflectance readings; results, though, are sometimes contradictory to visual examination. An investigation was made to determine the effect of color or chromaticity on the general acceptance of a white enamel. Enamel whites have a dominant wave length of about 480 mμ; the whitest enamels seem to be those with the highest residual color. Blue oxide additions may lower the reflectance, but they may also improve apparent whiteness. Yellow oxide additions must be avoided if a high degree of whiteness is required.

The relation of the particle sizes of the frit and color oxides to the color properties of porcelain enamels has been reported.(1) To obtain the maximum effect from a given color stain, the color particles should not be ground too finely. Not only does a small amount of the larger-sized color particle seriously impair the color characteristic of a specific oxide, but too fine a color particle will likewise decrease the color efficiency.

Increased reflectance is due to the increased interfaces of the opacifier and frit and to the increase in the number and the decrease in the size of the gas bubbles. The latter factor is important because of the greater relative difference in the indices of the refraction of the gas and of the enamel constituents.

The study of the fundamentals of the development of opacity in enamels centers around the solubility of the opacifiers, the crystallization behavior, the dispersion of the nuclei, and the growth of the opacifying crystals.

The development of opacity in zirconia enamels has been divided into two types, namely, (1) those whose opacity is due to the undissolved residue of the zirconia added and (2) those whose opacity results from the crystallization of a zirconia compound during firing.(1) An increase in the alumina, zinc oxide, and calcium oxide content in the glass causes a decided decrease in the solubility of the zirconium oxide opacifier. The fusion temperatures of the enamels is raised by a solution of zirconium oxide.

As in previous years, much attention has been given to enamel defects. One of the most common and annoying defects currently encountered in the enamel industry is the chipping caused by mechanical impact. A measure of the relative impact resistance developed by the National Bureau of Standards has since been adopted as a tentative standard test of the Porcelain Enamel Institute. The impact resistance of porcelain enamels apparently depends on many factors; it seems to increase as the cubic thermal expansion of the ground coat is lowered, depending somewhat on the bubble structure of the ground coat. High-expansion cover coats, in general, have better resistance than low-expansion cover coats.

Dissolved iron oxide has a definite effect on the physical strength of enamel. Ferric oxide appreciably reduces the enamel tensile strength, and ferrous oxide may have an even greater effect. Though little improvement of the physical strength of the enamel may be expected by a change in composition, the control of the iron oxide content of the ground-coat enamel may probably lead to increased strength and to resistance to impact and chipping.

Studies are under way on the solubility of iron in ground-coat enamels.(1) The tendency of dissolved iron to increase the coefficient of expansion of enamel has been demonstrated.(9) On the basis of smooth curves, the factor for Fe_3O_4 would be 5.3×10^{-7} as compared to 4×10^{-7} for Fe_2O_3. This may explain in part why enamels must be fired in an oxidizing atmosphere to secure adherence.

An investigation to determine the factors responsible for the tearing of enamels and the mechanism by which good film strength may be developed has been reported on.(1) The behavior of systems of soluble salts, such as exist in enamels below the fusion of the frit, definitely influences film strengths and the finished surfaces of enamels. The effect of plasticity of clays on dry-film strength has been studied elsewhere.(9)

Improper "set" causes difficulty in handling an enamel and contributes to several characteristic defects of acid-resisting enamels. The scumming tendency increases as set decreases. Set obtained in an enamel by the addition of an electrolyte is influenced by (1) the type of anion added, (2) the added cation, and (3) the valency of the added cation. The type and amount of electrolyte added to obtain good set do not affect the acid resistance of the enamel. Calcium oxide has been suggested as a satisfactory setting-up agent for acid-resistant enamels.

Work has been reported on the practical thickness of partial coatings of acid-resistant enamels. The results indicate that a combination of the various factors produced far more significant changes in acid-resistance coating thickness than did any single factor. The application method and firing temperature have the greatest individual effect on the thickness of acid-resistant enamel coatings applied by the partial-coating method.

The sulfate type of scumming has been claimed to be caused by sulfates either in the enamel materials or in the atmosphere to which the ware is exposed. Nonsulfate types of scums are usually caused by a combination of factors, which include underfiring, excess water vapor in the

* Superscript numbers in parentheses indicate reference to the laboratory which is conducting a specific research test, see page 101.

furnace atmosphere, fineness of grinding, and mill additions, especially clays and opacifiers.

An investigation of fish-scale phenomena recently reported was concerned with factors believed to influence the tendency to fish-scale, namely, the base metal, the clay in the enamel, and the effects of various furnace atmospheres. Fish-scaling is always accompanied by the evolution of gas. The use of proper enameling clay and low water vapor in the furnace atmosphere and the oxidation-control method of firing are practical ways of minimizing this defect.

A unique enamel firing furnace has been designed to make use of the controlled-oxidation firing process. The advantages of the controlled-oxidation process are as follows: (1) the copperhead formation is practically eliminated because of the lack of oxygen at the fusing temperatures, (2) the formation of fish scale can be definitely retarded, and (3) there is less scale formation of nonenamelled parts. Inert gas is introduced in the hot zone to reduce the oxygen content.

Tests on the abradability of enamels have indicated that borax is the principal factor in changing the abradability, which increases with increased borax content. An increase in borax at the expense of quartz increases the abradability more than a corresponding increase of borax with less feldspar.[9]

Sagging or the downward bending of enameling iron during the enamel firing process may create a number of undesirable effects. Various factors contributing to this sagging have been discussed. Phosphorus has been found to reduce the sag of laboratory-prepared enameling stock to a marked degree and it has appeared to have no marked influence on common enameling defects.

Work has been continued on the development of standard tests for enamels and enameled products.[1, 24] Tentative tests have found wide use in the various plants. Tests on enameled kitchenware are being expanded to cover all sizes and shapes of ware.[1] An effort is being made to standardize the flow test for porcelain enamels.[1] A comparison of flow control methods of enamel slips is also being made.[12]

Spectrographic technique has been used for the complete analysis of enamels, glazes, frits, ground coats, and opacifiers, as well as the constituent raw materials. Plant production problems have been solved by a periodic spectrographic check on the composition of the raw materials. The use of chemical analysis is more difficult and time-consuming.

The treatment of metal surfaces preparatory to enameling is a fundamental process of the enameling industry. The effect of cleaning the ware over a period of time was studied to determine the properties of a cleaner bath, such as pH, specific gravity, insolubles, and total solids, and the possible correlation of these changes with respect to cleaner-bath "performance." The data indicate a definite change in the properties of the cleaner bath after approximately the same amount of use.

Cleaning metal stock by the Tainton nascent sodium process has been studied.[9]

Other enamel researches include (1) the comparison of control constants for double and single nickel salt dips[9]; (2) studies on enamel slips[2,3]; (3) studies on ground-coat enamel adherence[2]; (4) an investigation of the behavior of clays in enamels with respect to the development of reflectance, good slip properties, and occurrence of defects[1]; (5) a study of the relation of the compositions of the enamel to the properties of enameled kitchenware and an investigation of properties of kitchenware now on the market[1]; (6) a study of the application of thin, uniform enamel ground coats by electrical means; (7) an investigation of the effect of different types of oils on the screen process for decorating enamels; and (8) a study of the development of defects by the microscope and moving-picture camera.[1]

Glass

The present picture of the atomic arrangement in glass has developed from four kinds of information, namely, the laws of crystal chemistry, the X-ray diffraction study of glass, the kinds of materials, and the ranges of composition in which glassforming properties exist. X-ray diffraction studies establish the predominant type of bonding in the glass, for example, the tetrahedral bonding in silicate glasses. Secondary structural features, such as those which change with annealing or conditioning, do not show up in the X-ray pattern. Most of the proposed structures are those which are suggested and are partially substantiated by X-ray studies, those which fit the laws of crystal chemistry, and those which seem best able to explain the physical properties of glass.

X-ray studies have been made on soda-lime-silica glass.[10] The structure is similar to that of soda-silica glass except that some of the sodiums are replaced by calciums. Silicon atoms are tetrahedrally bonded to 4 oxygens. Each oxygen is bonded to either 1 or 2 silicons. If each sodium is assumed to be surrounded by 6 oxygens, each calcium must be surrounded by about 7 oxygens.

X-ray diffraction studies have been made on potash-silica glass.[10] A Fourier analysis of the intensity curves indicates a structure similar to that found in soda-silica glass. Each silicon is tetrahedrally bonded to 4 oxygen ions, with each oxygen bonded either to 1 or 2 silicons. The K^+ potassium ions are situated in holes in the silicon-oxygen network with an average of about 10 oxygen neighbors.

X-ray diffraction patterns have been made of two lime-phosphate glasses.[10] In these glasses, each phosphorus is tetrahedrally bonded to 4 oxygens at a distance of 1.57 A, and each oxygen is bonded to either 1 or 2 phosphorus atoms. The calcium ions, Ca^{++}, are situated in the holes in the phosphorus-oxygen network and have about 7 oxygen neighbors. In the lime-borate glass studied, some of the borons were triangularly bonded to 3 oxygens, and the others were tetrahedrally bonded to 4 oxygens.

A systematic series of investigations has been made on the elastic and viscous properties of several glasses of relatively simple composition with the object of seeking a molecular interpretation of these phenomena, particularly in the annealing range of temperature.[3] Work has been done on soda-silica glasses and more recently on potash-silica glasses.

It has been shown that the problem of immiscibility in glass systems can be interpreted in terms of valence and size of the atoms and also in the possibility of a given composition to provide suitable surroundings for each atom.[10] The theory has been extended to include a consideration of the temperature dependence. Miscibility is favored by the tendency of the network-forming cation to bond with all the available oxygens in the melt. Immiscibility is favored in compositions which do not allow the other cations to be properly surrounded by unsaturated oxygens.

The effect of composition and thermal history on the dielectric constants of soda-borosilicate glasses has been studied.[1] Heat-treatment decreases the dielectric constant and increases the density continuously as the temperature is lowered. This effect is greater for the glasses which contain the larger number of single-bonded oxygen atoms and the higher concentration of sodium ions.

Work has been carried out on tantalum glass, the K_2O–Ta_2O_5–SiO_2 series.[16] Tantala, as compared with SiO_2 and P_2O_5, is a poor "network-former." The high oxygen-to-tantalum ratio and the relatively large Ta–O distance result in the formation of new singly bonded oxygens and a glass that is loose in structure. Tantala occupies the position between BaO and PbO in its contribution to the properties of glass and may be substituted for BaO to improve optical properties.

The sodium disilicate-barium disilicate join of the ternary system, Na_2O–BaO–SiO_2, has been studied by means of the quenching method, and the phase-equilibrium diagram has been determined.[4] The two compounds form a binary system without intermediate compounds and without appreciable solid solution. The eutectic occurs at approximately 32% of barium disilicate by weight and at a temperature of 797 °C.

The knowledge of the phenomena of ionic exchange in glass is drawn from two sources, namely, from the exten-

sive study of base exchange proper and from work on electrolysis in glass. Some recent work has demonstrated that it is possible to transform a glass into a glass with a considerably higher silica content by exchanging some of its sodium ions by ammonium and later by the removal of the ammonium and its derivatives.[8]

The chemical durability test for glass containers, wherein distilled water is used as a leaching medium, has aroused considerable discussion as to its value. To secure reproducible results with such a test, the distilled water must be carefully prepared because certain impurities, of which copper is the most important, exhibit a marked effect on the alkalinity value. Some results indicate that the value of accelerated tests conducted with distilled water is questionable as an aid in predicting the resistance of various glass compositions to neutral solutions at room temperature. Accelerated tests, conducted with distilled water as the initial leaching medium, do not measure the resistance of a glass to a neutral solution but rather to an alkaline solution, the concentration of which increases at different rates for different compositions of glasses tested.

The effect of various liquids on the glass containers in which they are stored continues to receive attention. Much effort has been directed toward accelerated test methods. The relative resistance of glass bottles using accelerated water tests roughly parallels the relative resistance appearing in the room-temperature storage of unbuffered, neutral materials only if the various amounts of extraction are approximately the same at both temperatures. Bottle-surface tests with alcoholic solutions of various strengths and with distilled water show that corrosion decreases with increasing alcoholic concentration.

The durability of optical glass has been studied.[22] Two general types of change in the polished surface were noted in the cases where weathering had taken place. Glass that remained in a humid atmosphere for a long period of time became covered with a hazy film of soluble alkaline salts. All glasses are subject in different degree to such dimming in contact with water vapor. The second type of weathering is the formation of transparent silica-rich surface films because of the loss of high refractive index oxides, such as lead or barium, from the surface of the glass by solution in water. Laboratory comparisons of the stain resistance and the dimming rate of experimental glass melts have demonstrated the effects of compositional changes on durability.

Studies of the chemical durability of glass are being made by an interferometer method.[24] Treatment of the surface of a sodium-borosilicate glass at about 300°C. in a furnace containing volatile chlorides was found to improve markedly the resistance of the surface to acid attack.[1] Titration and conductivity measurements of aqueous extracts from bottles are being studied.[24] Chemical durability tests on various glasses have been subjected to comparison. The pH meter is used to estimate small amounts of extracted alkali. Comparative tests have been made on the relative solubility of different chemical glassware.[24]

The examination of certain glasses with the electron microscope is being undertaken.[1] The fading or solarization of glasses containing various decolorizers has been the subject of a spectrophotometric study. The work on changes in color of glasses produced by exposure to ultraviolet light is being continued.[1] A quantitative study of the fluorescence of glasses is under way.

An instrument has been devised to study the microscopic contour of surfaces in which the texture has a depth of a few ten-thousandths inch or less from the tops of the hills to the bottoms of the valleys.[22]

Photoelastic photographs have been made of transient stresses in glass before, during, and after fracture.[10] A certain minimum value of stress near the tip of a crack is required to cause it to propagate, its velocity (up to 5000 ft./sec.) depending on the rate at which the stress value is built up ahead of it. There is a strong stress concentration at the crack tip, which is pure tension at right angles to the crack.

Studies involving the composition of glasses versus properties include (1) the effect of barium oxide and of zinc oxide on the properties of a soda-dolomite lime-silica glass; (2) the use of topaz in opal glasses as a possible substitute for cryolite and sodium silicofluoride[3]; (3) the melting rate of soda-lime-silica glasses as influenced by composition and the effect of minor constituents; (4) X-ray diffraction and physical properties of potassium borate glass[10]; (5) the relation between the composition of potash-lime-silica glasses and various properties; (6) the composition and physical properties of special glasses[24]; (7) the temperature gradients in molten glasses studied in relation to their iron content[1]; (8) the thermal expansion of boric oxide glass and of crystalline boric oxide[24]; (9) the viscosity of soda-boric oxide-silica glasses[1]; and (10) the elastic and dielectric properties of glass.[3]

The electrical properties of glasses are receiving continued study: the electrical conductivity of glass in relation to the lithia, soda, and potassia content[1] (it was previously reported that an increase in resistance was produced by additions of MnO, ZnO, B_2O_3, Fe_2O_3, BaO, PbO, TiO_2, and K_2O, the resistances increasing in this order; a decreased resistance was produced by Na_2O, CaO, and Al_2O_3); the effect of thermal history on dielectric constants of glasses[4]; and the determination of the power factor of soda-lime-silica glasses.[20]

Phosphorus and phosphorus compounds, which are suitable fining and reducing agents for glasses to be melted under reducing conditions, have been applied in melting heat-absorbing and copper-ruby glasses.[3] Ferrophosphorus conveniently introduces both iron and a reducing agent for heat-absorbing glasses. By balancing ferrophosphorus and red phosphorus, it was possible to obtain glasses with the optimum FeO content under all melting conditions. Copper phosphide produced a superior copper-ruby glass which strikes at a lower temperature more rapidly.

Phosphorus pentoxide, which was first used to improve the color of heavy flint glasses, was later recognized as a valuable constituent of optical glasses, and the excellent ultraviolet transmission and low softening points of phosphate glasses have been found recently.[3] Glasses with a high P_2O_5 content have poor chemical resistivity which can be largely overcome, however, by the addition of Al_2O_3.

The removal of various forms of iron-bearing impurities from glass sands has been studied.[25] Iron occurs in many forms that may be divided into two classes, namely, stains and discrete grains of iron-bearing materials. Some stains are easily washed off or rubbed off during grinding; others are more difficult to remove, but the acid-leaching or attrition-scrubbing processes are successful. Discrete grains may be removed by gravity-separation methods if they are heavy, by magnetic separation if they are high in iron, or by froth flotation, regardless of their properties.

To mix the components of glass batches as intimately as possible, a method has been developed to co-precipitate and/or co-evaporate their components out of solutions. Batches thus prepared melt at a lower temperature and in a shorter time than chemically identical batches mixed from powdered components. The method promises to be useful in the manufacture of highly refractory glasses.

Other researches on glass under way or recently completed include studies of (1) the development of black,[23] red-silver,[3] and selenium-ruby glasses[23]; (2) the solubility of zirconia in soda-borosilicate glasses[1]; (3) thermal endurance tests on glass; (4) the use of chromium or vanadium oxide in glassmelting refractories to produce cords of low surface tension which disappear quickly and result in more homogeneous glass; (5) the spectral transmission of sodium borate glasses containing a small amount of cobalt oxide made at various temperatures up to the softening temperatures of the glasses[1]; (6) the use of the sonic test in examining glass[19]; (7) the effect of the chemical durability of glass on the asymmetry potential and reversibility of the glass electrode[24]; and (8) the diffusion in a commercial glass of certain salts of Au, Co, Cr, Fe, Pb, Pt, Cu, Tl, V, and Ag. Liesegang rings are formed.[1] The last three, and possibly Cu, show this phenomenon.

Refractories

Much work is being done on superduty refractories and on insulating brick. There are a number of defense projects in this field.[19, etc.]

Phase-equilibrium data have been an important factor in many of the refractories developments of the last two decades. These data are useful for silica, magnesite, chrome, dolomite, forsterite, and alumina-silica refractories.

The formation of mullite has always been desired in refractories because of its hardness, its small coefficient of expansion, its resistance to slag attack, and its many other useful characteristics. An investigation has been made of the catalyzing action of various oxides on the mullitization of kaolinite.[1] The oxides of Zn, Li, Mg, Fe, Mn, and Mo were found to be good mullite builders; Na, K, Ti, and Sn oxides were poor; and B_2O_3 and CaO were fair accelerators.

A general research is under way in the field of kyanite refractories.[19] The problem at the present time is to substitute the fine-grained domestic kyanite for the coarse-grained product imported from India, the importation of which has ceased. The problem is to agglomerate, by using fluxes, the finer-grained domestic product into an acceptable grog at as low a temperature and in as short a time as possible. The use of Virginia kyanite in refractories is being studied,[8] and the substitution of domestic kyanite and artificial mullite for India kyanite is receiving attention.[25]

A preliminary investigation on the physical properties of massive topaz indicates that (1) topaz replacements improve the properties of a fire-clay refractory body, (2) high topaz replacements decrease spalling resistance, and (3) topaz fires to a good white color. It is converted to mullite at a relatively low temperature and has a low thermal expansion.[5] It should serve the same purpose as andalusite and dumortierite in electrical porcelain, particularly in spark-plug bodies. The effect of heat-treatment on the chemical, physical, and mineralogical properties has been investigated. The thermal decomposition of topaz is being studied.[25]

A study of the properties of pure alumina or a commercial type of corundum bonded with Lumnite cement has been reported.[11] This calcium aluminum cement, used as a bonding agent for pure corundum, has good working and fired properties. P.C.E. determinations have been made which show that free silica is extremely detrimental to refractoriness. The best refractory sample seems to be the one composed of a large proportion of fine-grained corundum and bonded with 5 to 12.5% of Lumnite cement.

Work on the secondary expansion of high-alumina refractories has been reported also on permanent expansion in refired bodies that are compounded of high-alumina grog grains.[10] These expand because of the influx of silica from the fire clay through the liquid phase, the silica combining with the corundum in the high-alumina grog to form mullite.

Studies have been under way on the development of forsterite refractories[5,25] and on the properties of electrically fused forsterite.[25] The latter work has considered the technique, process, and composition of electrocast forsterite. The satisfactory behavior of the forsterite refractories manufactured from Pacific northwest olivine has been attributed to the high density obtained by grain-size control and to the proper addition of conversion agents.[12,25] Work has also been done on bonding agents for granular forsterite refractories from North Carolina olivines.[5]

Other refractories studies involving composition include (1) the properties of refractories prepared from olivine, aluminum, and magnesite[9]; (2) the development of a fire-clay refractory with silica grog[12]; (3) the investigation of the zirconia–spinel system as refractories[10]; (4) refractories for steel plant use[2]; (5) the production of insulating refractories from pyrophyllite[5]; (6) the development of unfired aluminous refractories for ladle linings[1]; and (7) the development of insulating and lightweight refractories.[19]

The testing of refractories has received widespread attention. Refractories materials are frequently tested for crushing strength and for modulus of rupture after being subjected to a prescribed heat-treatment and cooled to room temperature before testing. This, however, does not give the strength of these materials at elevated temperatures. Equipment and a technique have been worked out for such tests. Results on various refractory materials indicate a general tendency for the crushing and modulus of rupture to remain relatively constant from room temperature to 1800°F. The strength, in most cases, is somewhat higher from 1800° to 2000°F. and is considerably higher in this range in the crushing test on high heat-duty and superduty fire-clay brick. In a previous study on the deformation of insulating firebrick under load, no correlation existed between the weight and the resistance to hot loading or between the cold crushing strength and hot load-bearing capacity. A study has been made of the elastic, plastic, and creep properties of refractories at several temperatures.[24] A symposium was held on testing methods for refractories.[19]

Other tests on refractories which have been reported include tests on (1) the relation of the permeability and specific gravity of insulating refractories[11] (38 insulating refractory brick were tested for permeability to air and for bulk specific gravity; the data show that the pressure at which turbulent flow occurs decreases with an increase of service temperature, and the ratio of apparent permeability to pressure tends to increase with service temperature); (2) the effect of kiln atmosphere on various refractories[22]; (3) the spalling resistance of various refractories at different temperatures[24]; and (4) the development of tests to predict the probable behavior of refractories in service.[22]

A laboratory test has been developed to test refractories against molten calcium metaphosphate. The results obtained are similar to the results found in a large-scale plant furnace. Refractories containing more than 85% of zircon show the best resistance in the corrosion test.[25]

Electric furnaces for smelting iron ores have been developed further. Such furnaces may be used in localities where the government is developing the production of hydroelectric power. Standard American firebrick meet the specifications for these furnaces. A study of brick failures in aluminum-melting furnaces indicates that failure resulted from the penetration and reaction of the aluminum. Studies have been made of used-lining failures of blast-furnace linings.

Other electric furnace studies under way are being made on (1) an electric furnace for high-temperature refractory firing; (2) the design and operation of an electric load kiln for superduty service; (3) the design and operation of an electric P.C.E. furnace for superduty service; (4) an electric spalling test kiln; (5) graphite electric heating elements; and (6) individual mineral components produced synthetically in the electric furnace.[25]

The effects of various factors on air-setting refractory bonding mortars have been studied.[4, 24] The properties of bonding material in some refractory bodies are receiving attention.[5] A study of the properties of some furnace cements has been started.[1] Work is being done on high aluminous cements and on the use of low-grade bauxite in such cements.[25]

Other researches on refractories and allied problems include studies of (1) the specific heats of chrome and magnesia refractories; (2) the effect of mineralizers on underload refractories[22]; (3) the effects of coal-ash slags on firebrick at different temperatures, which have been studied with a modified arrangement of the testing furnace with a rotating burner; powdered coal ash is fed through the burner during the slagging period[1]; (4) the viscosity-temperature characteristics of some coal-ash slags[1]; (5) basic refractory mortar[13]; and (6) general problems on refractories.[23]

Structural Ceramics

Problems peculiar to the use of paving brick in the highways are the subject of a self-perpetuating research sponsored by the National Paving Brick Association.[19]

The development of a modified rattler test, the planning and inspection of experimental highway sections in cooperation with the Ohio Department of Highways, fillers, and the temperature gradients in brick highways have been studied. At the present time, the U. S. Bureau of Mines is cooperating with the Public Roads Administration (Federal) and the Ohio State Highway Department in evaluating paving brick manufactured in Ohio as placed in highways. The problem of the low cost for construction has led to a study of reinforced brick pavements which seem promising. A test road is being studied in an attempt to correlate the service of brick with laboratory tests and thus be able to predict the serviceability of paving brick under present-day traffic.

The Glazed Brick and Tile Institute is sponsoring work on the properties of glazed units.[19] One problem in this research has been to determine the time factor in the fire-wall test.

The commercial product was unsatisfactory in these tests. The change in design of the tile, and, in some cases, in the body composition, has improved its fire resistance.

The problem of vapor glazes has been of interest for many years, although little is known of its mechanism. A résumé of the technical literature on salt glazing has been reported. A fundamental study of vapor glazes and vapor glazing, which attacks the problem by means of triaxial diagrams and X-ray spectroanalysis,[19] is under way. The salt glaze as a commercial product in structural ware is becoming obsolete owing to the fact that these glazes develop a fine craze during their fabrication. Work on the development of an noncrazing salt glaze has been successful in laboratory and experimental plant trials.[19]

Work has been done on small prefabricated sections of brick and tile. Prefabricated ceramic members which use prestressed steel reinforcing rods have a logical position in commercial construction. The elimination of forms obtained by this development should provide definite economies. New means of installation of tile have been studied.[4] The effect of deairing on the physical properties of structural clay products is being studied elsewhere.[24]

The beneficial effects of deairing on stiff-mud brick is well known, and it is now common practice to deair stiff-mud brick. When investigating the effect of deairing on soft-mud brick, it was found that deairing tends to stiffen such bodies; it therefore permits the use of less lime, which results in stronger brick.[9] Precast reinforced masonry panels for residential construction and a grouting mortar for cavity wall construction are being studied.[13]

Work has been done on the use of soda ash and admixtures of soda ash, oleic acid, kerosene, and pine oil to reduce the power needed for extruding plastic bodies. The power used for extrusion was determined by the measurement of the increase in temperature of the plastic mass during fabrication.

Large losses are sustained in some plants because of the cracking of clay products during drying. One of the most effective ways of improving the drying behavior of clay is to add about 0.2% of $FeCl_2$ to the clay. Wetting agents, sodium chloride, soda ash, and hydrochloric acid also improved the drying properties of certain clays.[9] The effect of additions of some electrolytes and organic content on the drying characteristics and moisture gradients in clay bodies is being studied.[1]

During an investigation on the properties of the pore system in brick and their relation to frost action,[24] the air and water permeabilities were determined on different brick specimens. Under continuous flow, the air permeability was constant with time of flow; the water permeability, however, increased or decreased, depending on the size of the mean effective capillary radius of the brick. The ratio of air-to-water permeability was not inversely proportional to the viscosities of the two fluids, in conformity to Poiseuille's equation, although the ratio approached this proportion as the mean effective capillary size of the brick increased.

Whether soft-mud, stiff-mud, or dry-press brick are strongest or most resistant to freezing is debatable. In all clay tests, the soft- and stiff-mud brick were stronger and more resistant to freezing than the dry-press brick.[9] For New York shale, stiff-mud brick were stronger and more resistant to freezing than soft-mud brick. For Hudson River clay, however, there is little difference between the quality of stiff-mud and soft-mud brick. Hudson River soft-mud brick do not absorb and retain so much water as other brick and therefore should be more resistant to freezing.

Fire-clay brick high in iron compounds too frequently become disintegrated from the action of carbon monoxide. Brick containing pyrites and magnetite are less resistant to this type of disintegration than brick containing hematite. Firing brick to a higher temperature is one of the most effective ways of preventing this type of disintegration.[9] The phenomena of color changes produced in iron oxide-bearing materials when fired in a reducing atmosphere are being investigated.

A satisfactory body for sleeves, nozzles, and runner brick is being developed.[19] The study varies in its scope from the winning of the clays themselves through the method of fabrication and the use of the finished product.

When brick masonry mortars are not used two to three hours after they are made up they are too frequently thrown away. Such mortars can be aged one to five hours and then re-tempered with more water to produce mortars superior to freshly mixed mortars in their bond strength.[9]

New colors and textures for face brick have been produced by using color stains as well as oxides in the molding sands for Hudson River soft-mud brick.[9]

Researches on structural ceramics also include studies on (1) the use of the sonic test as an acceptance or inspection examination of certain structural products[19]; (2) acoustical products[23]; (3) the development of lightweight concretes from North Carolina vermiculites[5, 25]; (4) the properties of Illinois clays and shales as mortar mix materials[1]; (5) mortars and finishing plasters[22]; (6) structural plasters[22]; (7) the suitability of North Carolina shales for mortar mix[6]; (8) mortars with clay admixtures[13]; (9) thermal insulations[23]; (10) lightweight products[19]; and (11) glazing of common structural clay products.[12]

Whiteware

Whiteware research has been centered around the improvement of properties of ware, better glaze fit, and the use of new materials. Materials that may be restricted during the emergency have created concern, and considerable work is under way to reduce or eliminate these materials.

The Standards Committee of the White Wares Division is preparing a manual on test methods which will be published. This will include new testing procedures which did not appear in the 1928 Book of Standards.

Factors affecting the warpage of chinaware (molds, molding, and preparation causes) and the control of warpage during drying and firing have been studied.[25] Warpage is caused by (1) nonuniform shrinking during drying and firing, (2) handling in a damp deformable condition, and (3) irregular softening and support at the end of the vitrification period.

The modulus of elasticity is a factor that affects thermal endurance, but the stress-strain apparatus and procedure which has been used has not given values accurate enough to correlate this property with other physical properties. In an investigation on dinnerware bodies,[19] the elastic moduli were determined by a sonic-vibration method and by a refinement of the stress-strain method. The sonic method requires much less time than the stress-strain method and, in view of its greater accuracy, has decided advantages over the stress-strain method. It offers a means of testing ware by a nondestructive method.

The evacuation method of determining the absorption of bisque ware is now being used by one dinnerware plant. This method is fast and efficient.

The large purchases of vitreous ware for the various branches of the armed forces have started research on auxil-

iary fluxes or on more active fluxes, such as nepheline syenite.

An investigation was made to determine the effect of replacing feldspar with fritted fluxes of eutectic compositions in dry-pressed bodies of the vitreous and semivitreous types. Frits of oxides of Li, Ba, Ca, and Mg were combined with calcined Al_2O_3 and pulverized SiO_2. The eutectic fluxes shortened the maturing range of the body considerably and did not improve its strength.[23] Another investigation has dealt with raw versus prefused alkaline earth glasses as auxiliary fluxes.[2] The properties of some low-temperature eutectic glasses are now being studied.[2]

In substituting nepheline syenite for feldspar in hotel china bodies (if a lower firing temperature is not desired), it has been found better to reduce or to eliminate entirely the auxiliary flux rather than to use a reduced amount of nepheline syenite.[19] A good hotel china body is obtained when dolomite is used with nepheline syenite and when the firing is done from two to three cones lower.

Studies on talc bodies are under way, namely, (1) an investigation of talc minerals in electrical porcelain[2]; (2) studies of some factors affecting the properties of ceramic talcose whiteware[24]; and (3) a study of talc and pyrophyllite bodies.[12]

The use of a high sericite pyrophyllite in vitreous bodies has been considered. The substitution of this material for the flint in vitreous bodies is claimed to materially increase the fired strength. The increased strength is probably caused by the formation of mullite, with its resulting interlocking grain structure.

The preparation of titania bodies with fluxes maturing at cone 10 has been reported. Work is under way on the use of fluorine in ceramic ware[3] and on the use of vitreous silica in making low-expansion ceramic ware.[1]

The influence of firing and cooling rates on properties of a vitreous china body has been studied.[2] Moderate firing and cooling rates are apparently better than faster or slower treatments.

Other research on whiteware bodies includes studies on (1) floor- and wall-tile bodies[23]; (2) the constitution of bone china bodies[3]; (3) the effect of the particle-size distribution of raw materials on the properties of whiteware bodies; (4) the production of dental porcelain[19]; (5) vitrification[23]; (6) the effects of various temperatures and heating rates on whiteware bodies[24]; (7) the effect of topaz in porcelain bodies[5]; and (8) the uses of mica in various bodies.[13, 19, 24]

The properties of casting slips have been investigated.[1, 19, etc.] Of the various factors affecting castability, some of the more important are particle size, pH of body materials, consistency, specific gravity, soluble salt content, and base-exchange capacity.[19] The grain size of a body slip, especially the percentage finer than 1 micron, bears a fairly close relation to the casting rate of the slip when the condition of the slip is such as to produce a cast with the correct feel or degree of plasticity. Other factors being equal, the lower the percentage finer than 1 micron, the higher the rate of cast. The pH of a casting slip does not change greatly with age up to 96 hours.

The effect of the use of barium carbonate and sodium silicate on the control of the adsorbed salts in English and domestic clays has been studied (sanitary porcelain plant). Although English ball clays are not necessarily freer from salts than domestic clays, English china clays seem to be freer from salts than domestic china clays. The quantity of salts present varies directly with the length of time the clay has been mined (this was explained as due to the oxidation of pyrite). If the correct amount of barium carbonate is added, there is practically no variation in the amount of silicate required for a particular clay.

Preliminary work[23] on centrifugal slip casting indicates that this is an interesting method for lessening the casting time and for lowering the firing shrinkage of ceramic bodies. Slip-cast plates have less tendency to warp during firing than plates of a similar body made by jiggering.[25]

Organic deflocculants are better than inorganic deflocculants because they do not cause dry edges and blisters on one-fire cast ware and because they are not so destructive to plaster molds. The effect of 21 organic deflocculants on the viscosity of clay slip has been studied.[9] Synthetic dispersive agents also are receiving attention.

The mechanical properties of plastic clay masses have been investigated in terms of the fundamental concepts, stress and strain, and the interpretation involved in the general terms of plasticity and workability. Aging increased the plasticity of ball clays progressively, and the china clays and a porcelain body became more workable. Increasing the rate of stress application caused progressive increases in the equilibrium stress.

Various plasticizing and binding agents are being tested. Alginates have been substituted for gums.[19] Some materials can be used because of their film-forming power and adhesiveness. The effect of wetting agents on properties of clay bodies is being studied.

The application of dry mixing of ceramic bodies is increasing.

The effect of the glaze film on the properties of a vitreous china body has been studied further.[2] To correlate glaze and body thermal expansions with the resultant glaze stress, the glaze expansion should be taken to its softening point. Individual measurements of glaze and body thermal expansions are not always sufficient to establish the resultant glaze stress. The tuning-fork and ring tests may both be used to correlate the glaze stress condition with the effect of the glaze on the properties of a vitreous china body. Glazes in moderate or higher compression increase the flexural strength of glazed bodies considerably, whereas glazes in low compression or tension on these bodies considerably decrease the flexural strength.

Over twenty years ago, most of the porous glazed wall tile crazed in service owing to the moisture expansion of the body. By introducing talc into such bodies, this crazing was overcome; some wall-tile manufacturers are now making tile which will withstand a 400-lb./sq. in. autoclave test without crazing. Research indicates that zircon and pyroxenelike talc tend to reduce the moisture expansion and therefore can be used in place of talc to overcome delayed crazing.[9] When zircon is substituted for a portion of the talc or feldspar, the temperature range between crazing and shivering is greater.

In the early work on moisture expansion of ceramic bodies, it was shown that the expansion which takes place during a comparatively brief autoclave treatment is definitely related to the expansion during long exposure to air.[21] Additional data have and are being taken to show the expansion that develops during varying lengths of time in storage or in service and the relation of these values to the autoclave test.

A study is being made of the relation of afterexpansion to glaze crazing and to other properties.[19]

The repeated wetting and drying of a fired clay body, in the absence of freezing and thawing or of thermal shock, may produce a permanent gain in weight or in moisture expansion.[1] These effects decrease when the firing temperature is increased and when the porosity of the body is decreased. The tendency of soft, fired clay bodies to decrease in strength in open storage may be eliminated by proper vitrification.

A study has been made of the effects of firing temperature and changes of composition on the reactions between certain raw lead glazes and a body.[1] The glaze body interface was examined microscopically by preparing thin cross sections. One report indicates that the interfacial layer is not necessarily intermediate in expansion conduct. Various studies on the body-glaze interface, concerning the effect of thin mineral layers on crazing, the crystalline development at the interface, etc., have been reported recently.

Particle-size distribution in glazes has been studied to correlate the particle size with the glaze-working properties and with certain physical properties of the glaze film, such as fluidity, microtexture, scratch-hardness, and glaze stress. Measurements on commercial shipments of stains and other raw materials, such as flint and feldspar, indicate a considerable variation from shipment to shipment;

this variable in ceramic production should be corrected as much as is commercially feasible.

A study has been made to relate the basic properties of raw materials to a practical determination of their role in glaze slip behavior.[1] The determination of the deposition constant and limit and coherence value are being studied with respect to such variables as kind of clay, ion adsorption capacity, milling treatment, water content, electrolyte concentration, slip temperature, and aging.

Reflectance measurements of typically glazed ceramic bodies were made using the Hunter multipurpose reflectometer.[1] The thickness and composition of the glazes were varied. Conclusions from this study were (1) that neither the changes in thickness nor composition significantly affect the gloss or reflectance of lead borosilicate or raw lead glazes (such changes, however, significantly affect the reflectance of a Bristol glaze) and (2) that the SiO_2 content of a porcelain glaze has a marked effect on the specular gloss.

The advantages of phosphates as opacifying agents in sanitary-ware glazes have been observed.[2] A satisfactory opacity and white color were obtained with tricalcium, trizinc, and trimagnesium phosphate and with calcium pyrophosphate. Calcium pyrophosphate in a commercial low-alkali glaze produced a color, opacity, and texture that was indistinquishable from the same glaze opacified with tin oxide.

Zirconium in a glaze not only increases its chemical durability but also its resistance to abrasion and to crazing even when the amount added is less than that necessary to produce opacity. Flint increases the abrasion index of the glaze, but at a lower rate than zirconium silicate. Small additions of zirconium silicate may soften the glaze; higher additions increase the refractoriness.

Other studies on glazes comprise (1) work on leadless glazes to replace lead glazes; (2) glaze composition studies to reduce or substitute for certain oxides which are or may be restricted by priorities, i.e., ZnO, SnO_2, and certain coloring oxides, CoO, Cr_2O_3, etc.; (3) studies of the fundamental reactions of glaze constituents[24]; and (4) work on eutectic fluxes and glasses.[2]

Materials

Much work is under way on the beneficiation and utilization of various minerals. Problems dealing with purification and preparation for market of materials for the ceramic industry have been dealt with.[25] The various ceramic applications must also be determined. Numerous investigations related to national defense have been carried out.

Pure and well-defined clay minerals are being studied mineralogically by X-ray diffraction, particle-size distribution and shape (electron microscope), viscosity, plasticity, and electric charge. Various clay minerals and size fractions of minerals are being studied with the electron microscope.[2]

Work has continued on the substitution of domestic clays for imported clays. Attempts have been made to synthesize a casting clay that will duplicate the properties of the best English casting clays.[19] This substitution is essentially a study of grain size, base exchange, and peptization. Although English clays are still coming into the United States, most manufacturers prefer a domestic supply. There have been a number of papers and discussions on this subject.

The Research Committee of the White Wares Division has inaugurated a program for the classification and testing of ball clays. The objective is to set up standardized test methods by which classifications can be reached. An evaluation of clays for all known uses has been worked on.[25] Such test methods will enable anyone interested in a particular clay to classify it into possible use groups, as a preliminary step in its evaluation.

The clay resources of northern Mississippi are being investigated for the manufacture of structural clay and refractory products.[19] Although there is a dearth of clay-product manufacture in the Memphis area, there are many unproved raw materials which vary from a lightweight clay through a loess to a high-grade semikaolin.

The properties of the Pennsylvanian shales in Illinois have been studied.[21] These shales are composed principally of the clay minerals (illite and minor amounts of kaolinite) and quartz. Chloritic mica, limonite, organic materials, feldspar, and heavy minerals are minor components. Those shales which show silicification of the clay minerals have lower values for their unfired properties. Base-exchange capacity has a direct bearing on the unfired properties. The correlation, however, between base-exchange capacity and unfired properties cannot be close unless all materials have exactly the same mineral composition and unless the same exchangeable base is present in each material.

During the past years, considerable attention has been given to base-exchange phenomena in clays or to the replacement of bases or cations in or on a body by other cations. Calcium is the predominate exchange mineral in natural clays; 70 to 90% of the exchange positions are held by Ca and Mg ions. Clays with low base-exchange capacity are, in general, nonplastic; clays with a higher base-exchange capacity are more plastic.

Clay refiners want a minimum settling which is obtained with a Na-clay. In casting, the lowest viscosity is desired, which again is attained with a sodium clay. The electrolyte added (sodium silicate and sodium carbonate) effects a base exchange which gives a Na-clay from the natural Ca-clay. For jiggering, a high viscosity is wanted, or the viscosity obtained with the Ca-clay; better yet, with an Al-clay; and still better, with an H-clay.

The effect of exchangeable bases on various properties of clays has been studied extensively. The Na-clay has the greatest effect on most physical properties. Clays are prepared experimentally by first electrodialyzing to produce the hydrogen form, then by treating with various reagents to obtain the type of clay desired, e.g., a K-clay, Ba-clay, etc.

Studies have been made on the electrophoretic dewatering of clay suspensions.[25] The more colloidal a clay, the more pronounced are its electrical characteristics. Many of the ball clays that are difficult to filter-press should lend themselves to the electrical method of dewatering. The effectiveness of such a process depends on many variables, such as the orientation of electrodes, the time of deposition, temperature, current density, and pH of suspension.

Froth flotation as a means of improving the quality of clay has also been studied.[25]

Marked improvement in the workability of clays and in the quality of the fired products can be attained with many clays by a control process that involves the regulation of pH and the character of base saturation by the addition of sodium carbonate and other alkaline materials. The amount of basic material needed to effect control is easily determined by titrating samples of the clay with alkali.

It is now recognized that the workability, or "plasticity," and the drying behavior of a clay may be influenced greatly by its electrolyte content. Measurements have been reported to determine the effect of cations.[3] Excellent correlations were noted between the influence of these ions on clays in the plastic state and their behavior in causing flocculation and deflocculation in dilute aqueous suspensions of clay.

A survey has been made of the literature pertaining to the measurement of plasticity, consistency, and fluidity.[11]

The addition of certain electrolytes, such as alkali salts, particularly alkali phosphates, to some clays brings about increased plasticity, especially when the clays are aged for a short time. The effect of selected electrolytes on the plasticity and refractoriness of some well-known fire clays has been determined. The dry strength of a flint and semi-flint clay from Kentucky and a similar pair of clays from Missouri was appreciably increased by aging with trisodium phosphate and secondary magnesium phosphate; clays aged with the trisodium phosphate alone showed the greatest increase with a maximum of 35%. P.C.E. tests indicate that the electrolytes can be used to improve

plasticity without materially lowering the refractoriness of the clay.

Measurements of the workability of various commercial ceramic bodies for plastic molding processes have been made with a modified Endell body tester.[13] Forming processes, which included hand-molding, jiggering, plastic-pressing, slip-casting, and stiff-mud extruding, were studied. The consistencies of bodies used for similar processes in different plants were in close agreement and it was generally possible to show the effects of substitutions of raw materials and of changes in the technique or machines used in preparing the bodies and shaping the ware.

Subsieve fractionation or particle-size control has received increasing attention. Clays and certain raw materials are now commercially available in a variety of grades of controlled particle size. These materials are no more expensive than the conventionally prepared products, and some of the centrifuged materials may be cheaper. Improved processing has resulted in clays of definite grain-size ranges and thus more uniformity in properties.

A study was reported on the properties of kaolinite as a function of particle size.[8]

The production of air-floated ball clays has been increased.

Researches regarding the fundamental properties of clays include (1) the examination of clay minerals with the electron microscope[2]; (2) an investigation of the effect of heat on the clay minerals illite and montmorillonite[21]; (3) the electrokinetic methods for electrocasting[25]; (4) the effect of exchangeable bases on some properties of ball clays[24]; (5) a fundamental study of the properties of kaolinite slips[10]; (6) the colloidal nature of kaolinite and flow properties[10]; (7) the electrophoretic mobility of clay and mineral suspended particles[25]; (8) the electrolysis of some fire clays[2]; (9) the influence of deflocculation on the physical properties of some ball clays[2]; (10) the conductivity of clay and other mineral suspensions[25]; and (11) the effect of anions on the colloidal properties.[3]

An investigation has been made of the thermal expansion of various silicate fluxes in the anisotropic and isotropic states.[2] The thermal expansion of the nepheline syenites investigated was nearly the same for the anisotropic and isotropic states and it is not greatly dependent on the amounts of the two phases present. Potash feldspars, low in free quartz, varied appreciably with the relative amounts of the two phases present. Potash feldspars, high in free quartz, showed less variation in thermal expansion between the crystalline and glassy conditions than did the potash feldspars which have a low amount of free quartz.

Nepheline syenite has been used in almost all types of glass, enamel, and whiteware products.[19] This material is now being used widely in low-temperature bodies.

Froth flotation and agglomerate tabling have been applied to numerous nonmetallic mineral mixtures to effect the concentration or beneficiation of these materials.[25]

Improved methods of concentrating spodumene has made this mineral available for ceramic use.[25] After proper cleaning of the mineral surfaces, spodumene can be froth-floated from associated minerals by different reagents; oleic acid is considered to be the best reagent. The use of spodumene as an ingredient in bodies is being studied.[9]

The use of American talc in ceramic bodies is of interest since our supply of foreign talc has been curtailed owing to the war. In preliminary tests, New York State tremolithic talc proved to be a much more powerful flux than French talc; in some cases, it could be used in place of French talc.[9] References to the use of talc in various bodies have been made previously. A study is being made of the acid solubilities of different talcs and their effects in bodies.[12]

Other materials being used in various ceramic applications include beryl, which is used in glazes and in thermal-shock bodies. The substitution of beryl for feldspar in a glaze will harden the glaze. Beryl is used in high-temperature chrome greens. The use of olivine, vermiculite (micaeous, hydrated silicates), and the kyanite family of minerals is still being investigated. The substitution of domestic kyanite and artificial mullite for India kyanite is a problem where the latter material has been in use. Fundamental studies on kyanite, its thermal behavior, and beneficiation (froth flotation) have been reported recently.

Phosphates have penetrated nearly all of the different fields of ceramics. They are used (1) in refractories to accelerate the inversion of quartz into cristobalite and tridymite and to prevent the formation of the stable phase in calcium orthosilicates, (2) in glazes as the chief constituent, (3) in enamels, and (4) in glasses (such as phosphate crowns for removal of the secondary spectrum, colorless heat-absorbing types, and fluorescent tubing). Only two uses are well known to the ceramist, namely, in bone-ash opal glass and in bone chinaware. The use of phosphates as opacifiers in glazes has been previously referred to.

The low cost of volcanic ash and its wide distribution in certain areas have aroused interest in its possible ceramic uses.[17] The iron content, however, has restricted the range of these proposed uses. Experimental work on the substitution of such a material in a standard hotel china body has been reported.[17] A substantial amount of volcanic ash may be used to replace ball clay and feldspar, thereby improving the plasticity, dry strength, and glaze fit of the body. Other qualities were satisfactory.

One of the potential uses of volcanic ash is as a component in glazes and in low-cost glass for the ceramic industry. There is a small amount of iron oxide present, however, which imparts a bluish green coloration to the frit that usually becomes yellow or ivory when it is incorporated in a glaze and fired in an oxidizing atmosphere. Attempts to remove the iron content of volcanic ash by concentration, by magnetic separation, and by leaching were uniformly unsuccessful, principally owing to the fact that the iron exists as a complex silicate. Promising results have been obtained with the use of decolorizers. Selenium alone for small amounts of iron, and selenium and arsenic trioxide for larger amounts were the most effective.

The effect of different alginates on the properties of ceramic bodies has been studied.[19] Of chief concern was the increased strength and workability derived from their use. The property of foam stabilization is an important factor in the forming of cellulated clay products.

Other investigations on materials include (1) miscellaneous pioneering and planning projects for various minerals as well as various nonmetallic surveys, e.g., a study on the properties and uses of Washington olivine[12]; (2) the beneficiation of talc[25]; (3) the fundamental properties of pyrophyllite[24]; (4) the concentration of diaspore from low-alumina clays[11]; (5) the extraction of alumina from Washington clays[12]; (6) the concentration of diaspore from low-grade Burley clays[11]; (7) the stabilization of dolomite by the addition of olivine[5]; (8) lime burning[23]; (9) foundry sands and clays[23]; (10) the investigation of the suitability of North Carolina clays and shales as substitutes for lime[5]; (11) the structure of calcined magnesite[9]; (12) the colloidal behavior of certain nonplastics [3, 10]; and (13) the thermal decomposition of topaz.[25]

General

The action of a considerable number of pure oxides, fluorides, chlorides, borates, phosphates, carbonates, and other compounds, as well as the effect of minerals in promoting or accelerating the inversion of quartz to cristobalite and tridymite at temperatures between 1000° and 1500°C. has been studied.[3] Alkali oxides are superior to all other substances, and they are effective in amounts less than 0.1%. Acid oxides seem to have little or no value as catalysts for this inversion. Another investigation on the influence of mineralizers on the quartz-tridymite transformation is under way.[2]

The fundamentals of cone deformation are being studied, including freezing, bloating, and delayed actions in general.[19]

The use of small series cones made of the nonplastic materials in the same proportion as in the body has been employed in an electrical porcelain plant. These cones

are fired, and the variations from standard are determined. The method was devised to check the uniformity of nonplastic shipments and to determine the blend of nonplastics needed when new and untried nonplastic materials are used.

The techniques involved in determining the P.C.E. of refractory materials have been scrutinized.[22] Material used for cone plaques should be selected carefully to prevent the migration of the lower melting constituents from the test cones to the plaques, or vice versa. Organic binders used in making up test cones of unfired clays may cause or increase bloating. A reducing fire during the test tends to accentuate bloating.

A symposium was held on the effect of kiln atmosphere during bisque, glost, and decorating firing on the ware properties.[2]

Considerable work has been done on the electric firing of ceramic products.[25] The uniformity of electric firing has also been studied.

One phase in the development of tunnel kilns has been directed toward kilns designed with small cross sections and for rapid rates of firing.[25] Car-tunnel kilns usually operate on a much shorter firing cycle than the large periodic kilns, but the maximum rate of firing has not been obtained in many instances principally because the cross section is still too large. A short, multiple-tunnel kiln should have many advantages over the present large, commercial, single-tunnel kiln; for example, it should have more rapid firing cycles, equal or greater uniformity of heat distribution, higher kiln efficiency, and greater flexibility.

An existing or possible gas shortage in certain districts due to the increased needs of defense industries has led certain plants to consider other fuels, such as oil or producer gas.

Recommended innovations for tunnel driers, which provide for a closer application of heat to the ware and for a more effective control, result in increased efficiency.

New methods of purifying water for the ceramic industry have been suggested and have found use in some enamel and whiteware plants. Salts are removed from water by the successive exchange of hydroxyl and hydrogen ions. The cations, in the first stage, are removed by the hydrogen exchanger. The partially treated effluent is then freed of anions in the second filter in which acid radicals are absorbed for the hydroxyl ion.

A delegation from The American Ceramic Society is continuing to cooperate with the Inter-Society Color Council. An attempt is being made to find what terms are used when talking of colors of ceramic products and what meanings are attached to these terms. A symposium has been held on color standards and measurements. The spectrophotometry of ceramic materials is receiving increasing attention.

Two of the most important variables in the production of ceramic colors are temperature and furnace atmosphere. The effect of furnace atmosphere on colors derived from chromic oxide has been investigated.[4] When chromic oxide is heated, the color changes toward blue. This color change is accompanied by an increase in particle size. An increase in the oxygen content of the atmosphere as well as in temperature and heating time effects an increase in the magnitude of the change; the oxygen content is the most critical.

Researches attempting to evaluate the use of spinels as ceramic colors are now being carried out.[10] A wide variety of spinels has been prepared, and their coloring properties in glazes and in stains will be studied. The development of a stable high-temperature pink stain is also in progress as a separate research.

Work on colorants, as previously intimated, has become an important consideration because of the present inability to obtain certain oxides; this difficulty will become increasingly more acute. A number of investigations on colorants are under way.[2, 4, 9, etc.]

The use of titanium stains in hotel china bodies has caused considerable trouble owing to color variation; the use of alumina and zirconium oxide extenders in the stain produce more uniform colors when fired under different conditions.[9] Conversion of anatase to the rutile form of TiO_2 has been accomplished by the calcination of TiO_2 with ZnO or a Zn compound.

Ceramic photographic processes continue to be investigated.

In the Art Division, a report was made on a fragment of Chinese Temmoku ware with "hare's fur" glaze, which was examined microscopically. The body was found to be overfired, jet black in color, and composed essentially of clay, quartz, and an unidentified anisotropic crystalline material. The glaze was brownish red at the edges of splinters, but in the thicker sections it was black and opaque. The presence of Fe, Ti, Ca, Na, K, Al, Si, and possibly Mg was shown.

It is suggested by the Chairman of the Art Division that a study which would indicate the order of formation of compounds in glazes and the different results obtained by form of introduction would be helpful to Art Division members. This would be interesting in the production of colors and colored glazes. A study of relatively small amounts of ingredients in mixtures that would decompose at temperatures at which other ingredients present would start to combine, thus starting vitrification and lowering necessary firing temperatures, e.g., the use of dolomite, would be helpful.

The subject of abrasives and abrasive action is of a very complex nature. Many diversified factors must be considered, e.g., the characteristics of abrasive grains, bonding characteristics, characteristics of "the work" being operated on by the abrasive process, and, of course, the conditions of abrasive use.

A number of analyses used in different ceramic laboratories have been improved.

A rapid and accurate volumetric method for the determination of iron as ferric oxide has been developed. The sample is fused with a mixture of sodium carbonate and borax, the melt is dissolved in H_2SO_4, the solution is reduced in a Jones reductor, and then oxidized with ceric sulfate, using orthophenanthroline as indicator. Interference by Ti, or other elements reduced by Zn, is avoided by the aeration of the solution after its reduction.

A rapid and accurate method for the determination of vanadium in the presence of iron and titanium has been obtained by the use of the orthophenanthroline indicator to establish vanadium in tetravalent form.

Work has been done on shortening the analysis of chrome ore without sacrificing accuracy.

The application of the infrared radiation to the evaporation and dehydration of silicic acid solutions derived from feldspars has been studied with the view of replacing the present water-bath evaporation and oven-dehydration procedures.

Other work of interest includes an improvement in the "Partition Method" for the determination of boron[24]; the rapid method of determining alkalis in cement[24]; the use of the polarized dropping mercury electrode for the quantitative analysis of alkalis in ceramic materials[11]; and the computation of titration blanks.[24]

In determining the specific gravity of fine powders, where hydration and solubility may occur, it is necessary to use some media other than water. A method worked out for refractory clinkers consisted of boiling the sample in toluene, employing a reflux condenser.

Other researches include studies on (1) the application of emission spectroscopy to ceramic problems[9]; (2) the measurement of the thermal conductivity of single crystals over a range of temperatures[10]; (3) flexible, greaseproof clay sheets made from bentonite slips[10]; (4) the use of different mounting media and different types of grinding powders in the making of thin sections of refractories and whiteware for petrographic study[1]; (5) the pyrometric cone equivalents of the sodium–alumina–silica systems[13]; (6) fused silica[25]; (7) an electric furnace study of the MgO–SiO_2 system; and (8) the thermal analysis identification of nonmetallic minerals.[25]

References

(1) University of Illinois, Urbana, Ill.
(2) Ohio State University, Columbus, Ohio.
(3) Pennsylvania State College, State College, Pa.
(4) Rutgers University, New Brunswick, N. J.
(5) University of North Carolina, Raleigh, N. C.
(6) University of Alabama, University, Ala.
(7) Georgia School of Technology, Atlanta, Ga.
(8) Virginia Polytechnic Institute, Blacksburg, Va.
(9) New York State College of Ceramics, Alfred, N. Y.
(10) Massachusetts Institute of Technology, Cambridge, Mass.
(11) Missouri School of Mines and Metallurgy, Rolla, Mo.
(12) University of Washington, Seattle, Wash.
(13) Iowa State College, Ames, Iowa.
(14) University of North Dakota, Grand Forks, N. D.
(15) West Virginia University, Morgantown, W. Va.
(16) University of Pittsburgh, Pittsburgh, Pa.
(17) University of Texas, Austin, Tex.
(18) University of North Carolina, Engineering Experiment Station, Raleigh, N. C.
(19) Ohio State University, Engineering Experiment Station, Columbus, Ohio.
(20) University of Illinois, Engineering Experiment Station, Urbana, Ill.
(21) Illinois Geological Survey, Urbana, Ill.
(22) Mellon Institute, Pittsburgh, Pa.
(23) Battelle Memorial Institute, Columbus, Ohio.
(24) National Bureau of Standards, Washington, D. C.
(25) United States Bureau of Mines, Washington, D. C.; various stations and the Electrotechnical Laboratory at Norris, Tenn.

—A. A. WELLS, *Chairman*

COMMITTEE ON STANDARDS REPORT

There has been an increase in interest in standards during 1941 and 1942, partially because of the war emergency. Because of this increased interest, this report of the Standards Committee is of more than usual value for the members of The Society. Most of the standards work has been done by other organizations, but during the year several of the Divisions of The Society have started on programs of standards work.

The American Ceramic Society is a cooperative organization for the promotion of the ceramic arts and sciences. To fulfill this purpose or reason for organization, it is essential that The Society should be interested in the formation of standard definitions, standard methods of testing, and standard specifications for ceramic materials, methods, and products.

As pointed out by R. B. Sosman[1] while he was president of The Society (1937–1938), it takes a permanent organization, well financed and especially set up for the establishment of standards, for any great amount of standards work to be accomplished. It requires an elaborate organization within which is a large number of men, well informed and experienced in the particular subjects considered, who are willing to expend the required time and energy for the formation of standards. Our Society contains within the membership the best-qualified scientists, technologists, engineers, and educators associated with the ceramic industry, but The Society is not designed for only standards work. It has many other activities and, rightly, the major portion of this work is left to the American Society for Testing Materials, the American Standards Association, and the several other similar organizations set up only for such work. The Society can help with the formation of standards by assisting these established organizations with their work and by starting the standardization of material, methods, and products where they do not exist at the present time.

The members of our Society, because of their knowledge and ability, are represented in many of these organizations and contribute greatly to their success. Each year The Society appoints one or more persons to represent the membership of The Society on these organizations or their committees if the work has some ceramic interest. Each year these representatives submit reports of the activities of these organizations, and the reports are compiled in this report of the Standards Committee. The members of The Society may thus learn of the work that has been accomplished during the year.

There are certain ceramic materials, methods, and products that have never been included in the scope of work of these organizations, and several of the Divisions of The Society have this year started work on the compilation of standards in these fields. This work is conducted by the Committee on Standards of the Division concerned, and the chairman of such Committee is a member of the main Society Committee. Summaries of these activities are herewith presented.

American Foundrymen's Association

L. C. HEWITT, Laclede-Christy Clay Products Co., St. Louis, Mo.: A meeting of the Joint Committee on Foundry Refractories was held on May 12, 1941, in New York, N. Y. The Association is preparing a handbook on cupola practice with a chapter on cupola refractories. This Joint Committee is made up of representatives from eleven organizations interested in the subject, and this handbook should prove valuable to producers and users of refractories. The American Ceramic Society representatives on the Committee are L. C. Hewitt, G. A. Bole, and J. L. Lowe.

American Society for Testing Materials

Committee A–1 on Steel, H. F. STALEY, Metal & Thermit Corp., 120 Broadway, New York, N. Y.: There have been no activities of this Committee during the past year relating to the ceramic industries.

Committee C–8 On Refractories, N. W. TAYLOR, Pennsylvania State College, State College, Pa.: This Committee has been active during the year and has prepared a new edition of the Manual of A.S.T.M. Standards on Refractory Materials which was published in January, 1941. Revisions were also made of several of the specifications which included methods of testing. Several tentative specifications were advanced to standard and revisions of Standards were adopted as standard. The activities of the subcommittees include (1) industrial surveys of refractory service conditions in zinc smelting and in iron cupolas; (2) a comparative study of gas-fired and electric furnaces for determining the P.C.E. of refractory materials and the testing of plastic fire clays, particularly those that bloat in the standard P.C.E. test; (3) the preparation of a bibliography on refractories for the period from 1932 to 1940; (4) the continuation of the compilation of data on insulating firebrick; (5) cooperation with the National Bureau of Standards on the development of a standard apparatus to determine the thermal conductivity of refractory materials at high temperatures; and (6) work on specifications for fire-clay plastic refractories for boiler furnaces and incinerator service and the consideration of specifications for ground fire clays for patching and daubing mixes and for air-setting mortars.

Committee C–11 on Gypsum, R. F. GELLER, National Bureau of Standards, Washington, D. C.: This Committee held only one meeting during 1941. Subcommittees reported on (1) the revision of tentative standard definitions of terms relating to gypsum, (2) revisions of standards for specifications for gypsum and gypsum partition tile or block, and (3) methods of testing gypsum and gypsum products. There was very little of immediate interest to members of The Society.

Committee C–14 on Glass and Glass Products, G. W. MOREY, Geophysical Laboratory, Washington, D. C.: The Standards Committee report[2] for 1940 included

[1] R. B. Sosman, "Standards," *Bull. Amer. Ceram. Soc.*, **17** [2] 68 (1938).

[2] "Report of Committee on Standards," *ibid.*, **20** [6] 218–20 (1941); p. 219.

several specifications on which this Committee has been active during the year. It has also been active on specifications C169–41T, Method of Chemical Analysis of Soda-Lime Glass and C162–41T, Definition of the Term "Glass."

A committee consisting of members from Committees C–1, C–14, and C–15, with probable representation from Committees E–8, D–9, and D–13, is being formed to consider the definition of the term "glass."

Committee C–15 on Manufactured Masonry Units, FREDERICK HEATH, JR., Colonial Clays, Inc., 311 Main St., Worcester, Mass.: The activities of this Committee have been confined largely to the development and revision of specifications for clay products. In response to requests from manufacturers, new specifications for vitrified clay block for trickling filters have been prepared. These products serve as a combination underdrain and ventilating block for the floors of filter beds in the trickling filters of waste treatment plants.

The tentative revision of the method for testing brick (C67–39) and the specifications for structural clay tile (C34–39 and C56–39) were adopted as standard.

A special working committee has studied and prepared recommendations covering requirements to be met in the visual examination of clay building brick. These were referred to the Committee on Clay Building Brick.

Studies have been made on possible specifications for methods of tests on freezing and thawing, efflorescence, and absorption rate (suction rate) for possible inclusion in the method of testing for clay building brick.

Consideration and study is being given to possible necessary changes in the specifications for glazed brick and tile.

Committee D–3 on Gaseous Fuels, C. H. PARMELEE, Onondaga Pottery Co., Syracuse, N. Y.: There have been two meetings of the main Committee and several subcommittee meetings during the year. Work has progressed at quite a rapid rate on a number of the subcommittee assignments, particularly those dealing with the standardization of the complete analyses of gaseous fuels. It is doubtful whether the Committee as a whole will complete the work on gaseous fuels in less than two years; some phases of it may extend beyond that time.

Committee D–9 on Electrical Insulating Materials, L. E. BARRINGER, General Electric Co., Schenectady, N. Y.: The activities of the Committee relating to ceramic materials are as follows:

(1) The dye-penetration test for determining the porosity of porcelain as described in A.I.E.E. Standard No. 41*a* was approved as satisfactory. This will be included in A.S.T.M. Method D116, Standard Methods of Testing Electrical Porcelain.

(2) Studies have been made relating to methods of testing steatite. A new tentative standard may be voted upon during the coming year. This tentative standard will include methods for the determination of power factor and dielectric constant, resistivity, dielectric strength, resistance to impact, flexural strength, compressive strength, and porosity.

(3) Progress has been made in outlining methods of testing glass insulators. Attention is directed to A.S.T.M. Methods D468–39T, Tentative Methods of Testing Pin-Type, Lime Glass Insulators, and D550–39T, Tentative Methods of Testing Glass Spool Insulators.

American Society of Mechanical Engineers

Petroleum Division, H. R. STRAIGHT, Straight Engineering Co., Adel, Iowa: There have been no activities of this Division during the year that would be of interest to the ceramic industry.

Process Division, W. KEITH MCAFEE, Universal Sanitary Mfg. Co., New Castle, Pa.: There has been no particular activity of this Division of interest to the ceramic industry. The Division, however, requests ways and means of stirring up useful cooperation between that Division and The Society. It is possible that the ceramic industry might offer some relief for the chemical industry in regard to substitute materials for process equipment.

American Standards Association

Sectional Committee on Minimum Requirements for Plumbing and Standardization of Plumbing Equipment (Project A–40), P. D. HELSER, Magnesium Allocation Office, War Production Board, Social Security Bldg., Washington, D. C.: Subcommittee No. 1 of Sectional Committee A–40 on Minimum Requirements for Plumbing and Standardization of Plumbing Equipment held meetings on April 16 and on October 24, 1941.

On December 9, 1941, Subcommittee No. 1 of Sectional Committee A–40 distributed seven sections of a proposed American Standard Plumbing Code to organizations and individuals known to be interested in the subject for their criticism and comments. The sections were as follows: sections (2) General Regulations; (3) Materials (Quality and Weight); (4) Joints and Connections; (5) Traps, Interceptors, and Cleanouts; (6) Hangers and Supports; (9) Water Supply and Distribution; and (13) Refrigerator, Safe, and Special Wastes.

According to the Committee's present plans, the complete Code will be made up of fifteen sections. The following sections are being prepared: Definitions; Plumbing Fixtures; Drainage (Soil, Waste, and Vent Lines); Drainage (House Drains and Sewers); Drainage (Storm Water); Inspections and Tests; Maintenance; and Administration.

The Subcommittee appointed at the first meeting for the preparation of a tentative draft of an American Standard Plumbing Code held seven meetings from April to December, 1941.

Sectional Committee on Recommended Practice for Brick Masonry (Project A–41), J. W. WHITTEMORE, Virginia Polytechnic Institute, Blacksburg, Va.: On June 1, 1941, a preliminary draft of building code requirements for masonry was submitted to the Committee. Comments on this draft accumulated up to November 21 were published. The Committee held a meeting on December 15, 1941, at the National Bureau of Standards, Washington, D. C., to consider the original draft, the published comments, and for further discussion. All recommendations and decisions made by the Committee have been referred to a Drafting Committee for a revised draft of Building Code Requirements for Masonry. The basis for the original draft was the Recommended Minimum Requirements for Masonry Wall Construction published in 1925 by the Building Code Committee of the Department of Commerce.

Sectional Committee on Coordination of Dimensions of Building Materials and Equipment (Project A–62), FREDERICK HEATH, JR., Colonial Clays, Inc., 311 Main St., Worcester, Mass.: For this Report, see the February, 1942, issue of *The Bulletin*, p. 31.

Sectional Committee on Insulators for Electric Power Lines (Project C–29), D. H. ROWLAND, Locke Insulator Corp., Baltimore, Md.: This Committee has been inactive. No meetings have been held for the past few years. It is, however, expected that sometime during 1942 a meeting will be called to pass on the new A.I.E.E. Standards for the Testing of High-Voltage Insulators.

Sectional Committee on Specifications for Sieves for Testing Purposes (Project Z–23), A. S. WATTS, Dept. of Ceramic Engineering, Ohio State Univ., Columbus, Ohio: The F.S.E.C. Technical Committee on Wire Screens and Wire Cloth is considering a proposal to revise Federal Specification RR–S–366 to agree with specifications adopted by the National Bureau of Standards, A.S.T.M., and A.S.A.

Sectional Committee on Specifications and Methods of Test for Safety Glass (Project Z–26), D. E. SHARP, Hartford-Empire Co., Hartford, Conn.: On November 17, 1941, a progress report was submitted to the American Standards Association by the Subcommittee on Safety Glass Code. The work of the Subcommittee has not yet been completed.

In the summer of 1939, upon the request of the sponsors of the Safety Glass Code and with the approval of the Sectional Committee by letter ballot, a Subcommittee was appointed to make preliminary tests as a basis for the

recommendation that the present Safety Glass Code be reopened for revision if it were found that the present Safety Glass Code requirements were inadequate to determine the following facts with regard to safety glass characteristics: (*a*) the relative resistance to quick removal of safety glass from frames in which such glass is ordinarily glazed; (*b*) the relative possibility of personal injury from flying glass; and (*c*) the change in safety features of such glass after prolonged exposure to weather and under extreme temperature variations.

The Subcommittee has held three meetings to date. The first was a preliminary meeting held in New York, N. Y., July 13, 1939. At this meeting, the Subcommittee considered the suggestions of the sponsors and approved a plan of procedure for the recommended investigation.

The second meeting was held at the Ford Motor Company plant, Dearborn, Mich., November 27 and 28, 1939. Extensive tests were made upon glass as glazed in a passenger automobile. On the following day, the Committee witnessed a series of tests conducted at the plant of the Libbey-Owens-Ford Glass Company in Toledo, Ohio. The third meeting of the Subcommittee was held at the National Bureau of Standards, Washington, D. C., May 17, 1940. Further tests were conducted at that time. Following this meeting, additional tests were made on aged glass by the National Bureau of Standards.

Extensive examinations of accident records were made by and in behalf of the Committee in the United States, Canada, and several foreign countries to determine, if possible, the extent to which glass is a factor in personal injury accidents.

At the last meeting of the Committee in Washington, D. C., a Drafting Subcommittee was appointed to prepare a preliminary report, summarizing the findings of the Committee and making recommendations for further research. Because of national defense activities, preparation of this report was delayed but was finally submitted to the members of the Drafting Subcommittee on December 16, 1940. The Drafting Subcommittee was in the process of putting this preliminary report into final shape when the pressure of national defense activities greatly increased. Early in 1941, it was found that a majority of the members were unable to devote sufficient time to the project to complete the report. An inquiry to the members of the Subcommittee on June 20, 1941, indicated that it would be undesirable to proceed further with the project at this time. There was every indication that at least one more meeting of the Subcommittee would be necessary before it could finish its report. To call such a meeting at this time seemed inadvisable. It is quite apparent, therefore, that work on this project must be tabled during the national emergency.

International Association for Testing Materials

S. M. PHELPS, Mellon Institute, Pittsburgh, Pa.: There have been no definite transactions in the I.S.A. because of the war emergency. Contact is being maintained with the British Commonwealths and with Latin American countries by the regular exchange of standards and other material. In South America, Argentina has an active national standardizing body, and one has been organized recently in Brazil. The A.S.A. maintains close cooperative relations with these groups.

In the latter part of 1940, there was issued a Spanish translation of pertinent subject matter from the Refractories Manual as issued by Committee C–8 of A.S.T.M. This has been distributed widely in South American countries where Spanish is used. As a result, an appreciable number of inquiries relating to standards and test methods has been received.

International Chemical Congress

ALEXANDER SILVERMAN, Dept. of Chemistry, Univ. of Pittsburgh, Pittsburgh, Pa.: The International Chemical Congress has not met during the year.

Inter-Society Color Council

WOLDEMAR WEYL (Chairman for The American Ceramic Society delegation to the Council), Dept. of Ceramics, Pennsylvania State College, State College, Pa.: The delegation of The American Ceramic Society to the Inter-Society Color Council organized a Symposium on Color Standards and Measurements which was held at the Forty-Third Annual Meeting of The American Ceramic Society in Baltimore. Owing to the splendid cooperation of members of the Inter-Society Color Council, members of our Society obtained a good picture of the efforts made to determine color terms, measure colors exactly, and eliminate vague limits of color tolerances. Deane B. Judd, of the National Bureau of Standards, Washington, D. C., who is the Chairman of the Inter-Society Color Council, in his Introduction to the Symposium discussed the "Methods of Designating Color." Color measurements are not completely unknown in the ceramic industry, for the next speakers were all more or less connected with the ceramic industry. The producers of coloring materials are, of course, the first to see the value of standardizing and measuring color, instead of arguing with the customer. F. H. Emery, Harshaw Chemical Co., Cleveland, Ohio, told of his experience of color matching with a spectrophotometer ("Spectrophotometry of Ceramic Materials"). Campbell Robertson, E. I. du Pont de Nemours & Co., Inc., Perth Amboy, N. J., explained the use of color charts, especially for opaque ceramic materials ("Color Standards for Opaque Ceramic Materials"). The Norton Company has developed in its research laboratories a handy system for designating colors and expressing the data of photometric measurements in a readily visualized system. R. M. Robertson and L. H. Milligan presented their system developed out of the needs of the ceramic industry in the form of a witty dialogue, which will still be remembered by our members ("A Readily Visualized System for Measuring the Color of Surfaces"). The Cambridge Tile Manufacturing Company, Cincinnati, Ohio, was one of the first manufacturing industries to secure the active cooperation of a color expert. I. A. Balinkin, of the Department of Physics, University of Cincinnati, and of the Cambridge Tile Manufacturing Company, devoted his talk to the "Measurement and Designation of Small Color Differences," which was based on his cooperation with the tile company. This Symposium was published in *The Bulletin*, **20** [11] 375–402 (1941).

In working toward a common basis for color designation, attention should be called to a recent publication by Dorothy Nickerson and S. M. Newhall on "Central Notations for ISCC-NBS Color Names" (*Jour. Optical Soc. Amer.*, **31** [9] 587–91 (1941)). This work, which has extended over more than ten years, is an extremely able solution for designating colors and avoiding misunderstandings. The color terms as well as the modifying adjectives should be generally accepted, and the Publications Committee of The American Ceramic Society would contribute to this aim by printing only the accepted color terms and avoiding ambiguous expressions. Attempts will be made to make this work available to every member of The Society.

Illuminating Society and Luminous Glassware Guild

W. C. TAYLOR (Chairman for The American Ceramic Society representatives), Corning Glass Works, Corning, N. Y.: There have been no activities on standards during the past year.

National Research Council

Division of Geology and Geography, R. B. SOSMAN, Research Lab., U. S. Steel Corp., Kearny, N. J.: This report will be published in *The Bulletin* later in the year.

Division of Chemistry and Chemical Technology, G. W. MOREY, Geophysical Laboratory, Washington, D. C.: The work of the Committee on Chemical Data for Ceramists, of which Alexander Silverman is chairman for the National Research Council, was reported directly to the General Secretary of The Society and was published in the June, 1941, issue of *The Bulletin*.

United States Department of Commerce, Division of Simplified Practice: Permanent Committee on Simplification of Variety and Standards of Vitrified Paving Brick

C. C. BLAIR, Metropolitan Paving Brick Co., Canton, Ohio: As there has been no desire by either manufacturers

or the users of paving brick for a change in the present standards, there has been no activity of this Committee.

DIVISION REPORTS, AMERICAN CERAMIC SOCIETY

Enamel Division

N. H. STOLTE, Enamel Products Co., Fremont, Ohio: Most of the standards work for this Division has been done by the Porcelain Enamel Institute. Many of the members of the Division are also members of P.E.I. and have assisted in many ways with that work. The Committee for the Division is making a more or less complete study of past standards to find which of these should be recommended for adoption. (A more complete report is to be submitted later.)

Glass Division

O. G. BURCH, Owens-Illinois Glass Co., Toledo, Ohio: The Glass Division as such has done little on standards in recent years except for the work which has been done in conjunction with Committee C–14 and other A.S.T.M. committees interested in glass products. The Standards Committee of this Division is giving consideration to further assistance with the development of additional standards of material, methods, and products for the glass industry. The following list gives many of the A.S.T.M. tests, specifications for glass, and glass products that are available:

I. Definitions

(*A*) Tentative definition of the term "glass" (A.S.T.M. designation C162–41T (1941)). (NOTE: The Glass Division of The American Ceramic Society went on record in September, 1941, as endorsing the first sentence of the above definition, "Glass is an inorganic product of fusion which is cooled to a rigid condition without crystallizing.")

(*B*) Standard definition of the term "sand" (A.S.T.M. designation C58–28).

II. Chemical Analysis of Raw Materials Used in Glassmaking

(*A*) Tentative methods of chemical analysis of glass sand (A.S.T.M. designation C146–396 issued in 1939).

(*B*) Standard methods of chemical analysis of limestone, quick lime, and hydrated lime (A.S.T.M. designation C25–29).

III. Methods of Analysis and Tests of Glass as Glass

(*A*) Tentative methods of chemical analysis of soda-lime glass (A.S.T.M. designation C169–41T; expected to appear in 1941 Supplement).

Supplementary to the above, the Glass Division did considerable work during 1940 and 1941 on investigations of "short-cut" methods for the determination of various constituent oxides in glass. No final recommendations as to the suitability of these methods have as yet been made.

(*B*) Tentative method of flexure testing of glass (determination of modulus of rupture) (A.S.T.M. designation C158–40T issued in 1940).

IV. Tests of Glass Products

(*A*) Tests on Glass Containers

(1) Tentative method of hydrostatic pressure tests on glass containers (A.S.T.M. designation C147–40T issued in 1939 and revised in 1940).

(2) Tentative method of polariscopic examination of glass containers (A.S.T.M. designation C148–40T issued in 1939 and revised in 1940).

(3) Tentative method of thermal-shock test on glass containers (A.S.T.M. designation C149–40T issued in 1939 and revised in 1940).

(4) Subcommittee III of Committee C–14 has been writing specifications for procedures for various types of chemical durability tests on glass. No definite recommendations have been made to date.

(*B*) Tests on Industrial Glass Materials

(1) Tentative method of testing and tolerances for glass yarn (A.S.T.M. designation D578–40T).

(2) Tentative method of testing and tolerances for woven glass fabrics (A.S.T.M. designation T579–40T).

(3) Tentative methods of testing and tolerances for woven glass tapes (A.S.T.M. designation D580–40T).

(4) Tentative methods of testing and tolerances for woven glass tubular sleeving and braids (A.S.T.M. designation D581–40T).

(5) Subcommittee VI of A.S.T.M. Committee C–14 on Glass Construction Block and Tile reports that some specifications and methods will be issued on this subject in the near future.

(6) Tentative methods of testing pin-type lime-glass insulators (A.S.T.M. designation D468–39T).

(7) Tentative method of testing glass spool insulators (A.S.T.M. designation D550–41T).

Materials and Equipment Division

G. J. BAIR, Mellon Institute, Pittsburgh, Pa.: This Committee has done very little work on standards as a Committee. The members of the Division have assisted as much as possible with the work of the Standards Committee of the White Wares Division and were especially interested in the Symposium on Ball Clays which was conducted at the Forty-Fourth Annual Meeting of The Society in Cincinnati.

Refractories Division

E. E. CALLINAN, Timken Steel & Tube Co., Canton, Ohio: The members of this Division are active in the work of Committee C–8, A.S.T.M., and through that work have developed an excellent Manual of A.S.T.M. Standards on Refractory Materials. The Committee is also considering work on an outline of sources of material, etc., that would further the standards work of the Division.

Structural Clay Products Division

H. C. PLUMMER, Structural Clay Products Institute, 1756 K St., N. W., Washington, D. C.: Committees of the A.S.T.M. and A.S.A. cover practically all of the products within the scope of this Division. In addition, the Structural Clay Products Institute and other similar organizations are working on standards and uses for these same products. The members of the Division are assisting in many of the functions of these several organizations.

White Wares Division

F. P. HALL, Onondaga Pottery Co., Syracuse, N. Y.: This Committee has been very active this year, and members of the Division through their Standards Committee are preparing a Manual of Standard Tests and Specifications of the White Wares Division of The American Ceramic Society (see Outline given on p. 25, February, 1942, *Bulletin*).

The Manual will not be completed this year, but considerable headway has been made in certain phases of the work. The standards on porcelain, particularly radio porcelain, have been assembled (see outline of Navias tests and specifications given on pp. 25 and 34, February, 1942, *Bulletin*), and a number of the tests and standards of raw materials has been assembled and were discussed at the Annual Meeting in Cincinnati. Some of these tests and standards have been approved. It is not the object to initiate any new specifications for manufactured products where these exist at present. It is desired, however, to assemble in one publication all existing standards and tests as applied to whiteware ceramic products.

Recommendations

The Committee on Standards recommends to the President and the Board of Trustees that application be made to the various organizations for representation of The American Ceramic Society on A.S.T.M. Committees C–1 on Cement, C–4 on Clay Pipe, C–5 on Fire Tests of Materials and Construction, C–6 on Drain Tile, C–7 on Lime, Technical Committee III of Committee E–1 on Particle Size and Shape, and on A.S.A. Sectional Committees B–7

on Abrasive Wheels, A–1 on Portland Cement, A–6 on Drain Tile, B–38 on Refrigerator Design, and B–44 on Thermometers.

The scope of these committees indicates that their work would be of interest to members of The Society, and undoubtedly the membership of our Society could be of assistance to these committees in their work.

The Committee on Standards further recommends that each Division of The Society continue the work that has been started on this very important phase of the work of The Society. If this is done, The Society will certainly be contributing further in the promotion of the ceramic arts and sciences.

—J. W. WHITTEMORE, *Chairman*

COMMITTEE ON DUST HAZARD (AIR HYGIENE) REPORT

This Committee has been functioning more or less as a stand-by Committee. Occasionally in the past years there has been a small amount of correspondence and some requests for information. This year there has been no activity by the Committee as such.

The Industrial Hygiene Foundation in Pittsburgh has been holding meetings at which papers covering the medical, legal, engineering, and testing phases of dust hazards have been given. They give a résumé of what is going on in their publications to members.

There is some work being done in Washington, Pa., on the use of alumina for treating silicosis cases. A meeting was held in Washington covering this subject. The Public Health Service reported on some studies made a number of years ago in the pottery industry, the results of which have been published.

The whole subject of air hygiene is changed from the original phase which was developed during the depression for defense from racketeering. This called for a quick collection of data by corporations for legal action. The next stage seemed to be the legislative stage in which an effort was made to clarify the situation by giving silicosis, for instance, a definite status as an occupational disease. This was quite active for a while, but has slowed down. We now have a situation in which there is a struggle as to what type of laws shall be passed on silicosis and other occupational diseases, with changes in definitions, tests, amount of compensation, and the method of administration for all forms of occupational hazards which may be classified as other than accidents. This includes lead as well as silica.

There may be an effort to amend some of the Occupational Disease Compensation Acts now in effect or to introduce new laws in states where such diseases are not compensable. The Dust Hazard Committee believes it would be to the interest of Society members if the Committee made reports from time to time with respect to such legislation.

The State of New York is considering the appointment of a Code Committee to draft a code for the regulation of dust, fumes, and gases in the ceramic industry. The New York State Department has already promulgated codes in other industries relating to the control of dust, fumes, and gases, and there is a probability that such an effort will be made in the ceramic industry. If promulgated, this code would probably be a model for adoption by other states in which the members of The Society may have special interests.

Ohio may be taken as an example. The Occupational Disease Law in Ohio was broadened during 1941. The time legally required for contracting silicosis was lessened from five years to three. Ohio ceramic manufacturers willingly cooperated with the Division of Safety and Hygiene of the Ohio Industrial Commission by taking steps to lessen the hazards to which their employees were subjected.

An article entitled "Dust Hazards in the Ceramic Whiteware Industry" was published in the *Ohio Industrial Commission Monitor*, **13** [11] (1940).

Silicosis became compensable in Ohio on July 31, 1937. From August 1, 1937, to December 31, 1941, 121 silicosis claims were allowed in the ceramic industry. A total of 327 claims were allowed in all industries during the same period. Those allowed in the ceramic industry amounted to 37% of the total. The foundries produced 169, or 51.7%, during that period.

The 121 claims allowed in the various divisions of the ceramic industry are listed as follows: tableware 36, floor and wall tile 29, glasshouse refractories 11, electrical insulators 8, silica brick 8, silica sand and diatomaceous earth 7, insulating brick 6, enamels 5, glass 4, stoneware products 3, sanitary ware 2, building brick and tile 1, and firebrick 1.

This report does not cover the actual activity of this Committee, but we have tried to give a survey of the general situation on dust hazards.

—F. C. FLINT, *Chairman*

COMMITTEE ON PATENTS

PROGRESS REPORT

Action Taken

In June, 1941, there was prepared and submitted a report on six bills (S. 674, S. 675, S. 918, H.R. 2526, H.R. 4238, H.R. 4782). These are related bills which are concerned with practice before the various agencies of the Government and are known as the Administrative Procedure bills. The Committee did not attempt to pass upon those bills in principle, but, inasmuch as some of them would affect practice before the Patent Office, the provisions pertinent thereto are matters of concern to The Society. For reasons which are detailed in that report, the Committee felt that it would be unwise to restrict practice before the Patent Office to attorneys-at-law, which would be the effect of all of those bills except S. 675 and H.R. 4782. It was recommended, accordingly, that any such bill be disapproved which does not provide that it does not apply to practice before the Patent Office.

The same report disapproved of another Senate bill, S. 1579. It provided that during any period of national emergency the President might, at his discretion, seize property of any kind, including patent rights, useful directly or indirectly for national defense, and that such property might be used by the Government or disposed of in any other way, temporarily or permanently. Without any desire to impede national defense, the bill was objected to because it was unnecessary for its stated purpose and because it was felt that an unlimited and unreviewable right of the breadth sought would be likely to do more harm than good to national defense and to the economic structure of the nation. The reasons were detailed in the report.

It may be said that S. 1579 was but one of several attempts to obtain legislation which would permit the seizure of patents purely at the discretion of an individual. All were vigorously opposed, and only S. 1579 became law and then only after revision in such manner that it does not apply to patents. Another bill of similar import has recently been introduced (S. 2303); this is covered by a special report submitted concurrently herewith. The reasons which impelled objection to S. 1579 apply equally to the present bill.

New Laws Pertaining to Patents

Assignment of patents has been governed by a statute known as R.S. 4898 (35 U.S.C.A. 47). In the past, there has been some doubt as to whether its provisions adequately applied to applications for patent. That doubt has been dispelled by an act approved on August 18, 1941

(Public Law 221), which amended the statute to include patent applications.

Public Law 700 (76th Congress) gave the Commissioner of Patents authority to order the invention of any patent application to be kept secret and to withhold the grant of a patent thereon whenever publication or disclosure of the invention might be detrimental to national defense. That act was found to be deficient in certain respects, and it has been implemented by a new act, Public Law 239 (77th Congress), approved August 21, 1941. Under the new act, no application for foreign patent may be filed on an invention made in this country except upon authorization from the Commissioner of Patents. A fine of not more than $10,000 or imprisonment for not more than two years, or both, may be imposed for violating any secrecy order issued against disclosure of the invention of a patent application or for filing a foreign patent application without license from the Commissioner of Patents where the invention of the application was made in this country.

Incomplete Work

President Littleton proposed that the Committee undertake to

". . . possibilities of giving a report to The Society on the present tendency and trends in the Patent Office; just how long can we expect their patent structure to hold; is the patent structure being undermined and weakened; is there definite desirable action from The Society needed; importance of patent structure on ceramic education and engineering and scientific education in general."

There is no doubt but that our patent system and its effects are being studied critically at the present time, both by its proponents and its opponents. This is due no doubt in part to the attitude of the Administration, particularly in the field of monopolies, as reflected by the T.N.E.C. hearings, suits that have been brought by the Government, and bills introduced into Congress. It is likely due in part also to the critical manner in which all of our institutions have been surveyed of recent years.

It is felt that for these and other reasons a study such as outlined above would be much worth while and in keeping with the aims of The Society. Unfortunately, that work has not been undertaken up to this time because the Chairman was unable, through unforeseen circumstances, to bring the matter actively before the other members. It is recommended, however, that this matter be referred to next year's Committee.

SPECIAL REPORT

The Committee on Patents submits the following special report on a bill recently introduced into the Senate as S. 2303 by Messrs. O'Mahoney, Bone, and La Follette. This bill, now being considered by the Senate Committee on Patents, would provide for the use of patents in the interest of national defense or the prosecution of war and for other purposes.

Under Section 1(*a*), when the President declares, during any war in which the United States is engaged, that the manufacture, use, or sale of any material, article, product, or commodity, or that the expansion of facilities or capacity for such manufacture, use, or sale is in the interest of national defense or of the prosecution of war, he may grant to any person a license under any patent or patents for the purpose of such manufacture, use, or sale. Such a license could be granted for any length of time and on any royalty basis prescribed by the President.

Under Section 2, the President would have the power in the interest of national defense to seize patents, patent applications, inventions, or licenses under any of them, and to issue licenses thereunder, merely by filing a notice of such seizure in the Patent Office. The sole remedy of the owner would be by suit in the Court of Claims.

It may be noticed that these rights of granting licenses and of seizing patents lie purely in the discretion of the President or such person, department, or agency to whom he may delegate that power. And the bill provides no possible review of any action taken under its provisions.

This Committee has no sympathy for any action or effort which in the slightest degree would impede national defense or the conduct of the war. It feels, nevertheless, that Sections 1(*a*) and 2 of this bill are wholly unnecessary, would be seriously detrimental to the public good, both at present and in the future, and are more likely to harm the nation than to accomplish any real or lasting good.

The fact is that the Government has the right at any time, during a war or not, to make use of any patent without interference from the patent owner. This freedom from interference is established by the Act of 1910, as amended in 1918 (35 U.S.C.A. 68). The right to grant express licenses or to seize patents provided for by S. 2303 is thus seemingly unnecessary. It may be noted also that all patent applications are open to the War and Navy departments, who may take advantage of any information gained therefrom and who may instigate the issuance of secrecy orders which prevent disclosure of those inventions and the granting of patents thereon. Thus the armed forces have available the information which is in the Patent Office but is not available to the public generally.

It is noted that under the bill there is no limitation on the term or the scope of licenses granted under either of the sections under consideration. Such licenses might be for the life of a patent, and they might be exclusive licenses. Nor is there any provision for terminating such licenses at the end of the war, nor for returning seized patents to their original owners. It seems evident, therefore, that there is no intention to limit the constructive effect of this bill to the period of the national emergency. Nor is it designed merely to the expansion of manufacturing facilities (one of the specific objects of the bill) because it would be possible to grant exclusive licenses under Section 1(*a*) or to seize patents outright under Section 2 and either grant a single license or no license thereunder. Such practice would take from the owner of a patent all of his rights in the invention and would thus prevent further manufacture, and the bill could be administered either so as not to speed manufacturing facilities or actually to reduce manufacturing facilities. Again, it would be possible under the language of the bill to seize not only single patents, but actually groups of patents or even all of the patents in a given industry.

These provisions are generally similar to two earlier bills, H.R. 3360 and S. 1579 (now Public Law 274, 77th Congress). Hearings were had on those two bills, one of which was considered by the House Committee on Patents and the other by the Senate Committee on Military Affairs. The overwhelming evidence was that such provisions would do more harm than good, that there was no necessity for such provisions, and that the Government has full right to use patented inventions without interference from the patent owner. In consequence, these patent provisions were removed from S. 1579 before it was enacted into law.

It is unnecessary to go into great detail in this connection because of the extremely detailed nature of the testimony which was presented in connection with the two similar bills just named. Briefly, it is thought that the enactment of this bill into law would deal a serious blow to the progress of the war and to scientific and technical development. The uncertainty which would arise would destroy the incentive to individual inventors to apply their inventive abilities. Again, such provisions could, and probably would, have a serious effect on postwar economy because, lacking the certainty of assured title to patent protection, much research work and investment would not be undertaken which would otherwise be done if there were expectation that the expense could be protected by our patent system. It goes without saying that the industrial preeminence of this country is due in large measure to research on an increasingly great scale which has produced new materials, new machines, and new methods. Enormous sums are devoted each year to such work, but the belief of those doing it is that the expense is justified by the strength of our patent system. If the protection which our patent system has offered is removed by this bill, the incentive to research and investment will in large measure

be destroyed, quite conceivably with results damaging to the nation. Research is vital to successful conduct of the war, and it will be equally vital to the economic situation which will follow the war. Nothing should be done, therefore, to discourage it.

The Committee recommends, accordingly, that Sections 1(*a*) and 2 of this bill be disapproved.

Under Section 1(*b*), it is provided that during any war in which the United States is engaged no injunction based upon alleged infringement of a patent or patents shall be continued or enforced during a period to be specified by the President. It is questioned whether such an act is needed because the Act of 1910 prevents any such injunction against one who is using the patented invention for the Government. Some doubt has been expressed as to whether that act applies to subcontractors, but in the considered opinion of many persons the Act does so apply. It is inconceivable, in any event, that any court would issue an injunction against manufacturing a patented article at this time if it appeared that the injunction would cause the slightest interference with national defense.

The Committee agrees that no one should be allowed to use the injunctive process of our courts to interfere with the conduct of the war, and on that ground it finds the principle here involved to be unobjectionable. It is thought, however, that instead of being restricted to patents, Section 2 should be broadened to prohibit the issuance, continuance, or enforcement of every injunction, the effect of which would be to retard national defense or to impair the conduct of the war.

For the foregoing reasons, the Committee recommends that The Society disapprove Sections 1(*a*) and 2 of S. 2303 and approve the principle of prohibiting the use of injunctions which would interfere with or impair national defense and the conduct of the war, but recommends that the principle be extended to all injunctions instead of being restricted merely to those involving patent infringement. The Committee recommends further that such action be certified to the Committee on Patents of both the House of Representatives and the Senate of the United States.

Signed by the Committee on Patents: FRANK H. RIDDLE, J. C. HOSTETTER, and FULTON B. FLICK, *Chairman.*

COMMITTEE ON MEMBERSHIP REPORT

In preparing an annual report, the Membership Committee is departing from precedence because it believes that the policies governing membership solicitation need to be re-examined by the Trustees of The Society. Any plan to modify these policies should take into consideration the following information:

(1) We are almost totally neglecting the value of the Annual Meeting as a member-getter. More than 40% of those attending these Meetings are not members, and many who attend year after year apparently are not convinced that membership would be worth while. There is no upward surge of membership applications at the time of the Annual Meeting.

(2) Ceramic students comprise a third of all new members taken into The Society each year.

(3) The rolls of the Local Sections of The Society contain the names of about 350 persons who are not members of the parent Society.

(4) Active membership work is carried out in the following ways: (*a*) continuous effective work by the General Secretary and his staff; (*b*) by the faculties of the ceramic schools (most are highly effective, but others are not very successful); (*c*) volunteer work by individuals; and (*d*) work by the Membership Committee. They increase the effectiveness of methods (*b*) and (*c*) and by numerous personal and group letters tap additional fields in which interest in ceramics may be found. The routine work of the Committee, such as preparing and mailing group letters, is handled by the General Secretary's staff. This is an immense amount of work.

(5) Owing to short-handedness in Columbus, the work of the Membership Committee cannot be carried out continuously but must be fitted in. Other lapses in this work occur during the annual reorganization of The Society. During the last year, this type of membership work was limited to less than five months of the year. The following breakdown indicates that nothing better can be expected under the present arrangements:

	Months of active work	Months of inactivity
APRIL 1 to JUNE 15		
Society reorganization, including 5 weeks for the Committee to organize itself and plan work.		2.5
JUNE 15 to OCTOBER 1		
Active work.	3.5	
OCTOBER 1 to NOVEMBER 15		
Office congestion due to Autumn Meetings.		1.5
NOVEMBER 15 to DECEMBER 1		
Active work.	0.5	
DECEMBER 1 to JANUARY 15		
Committee did nothing. (Would year-end deluge have stopped work anyway?)		1.5
JANUARY 15 to MARCH 15		
Office congestion due to Annual Meetings.		2.0
MARCH 15 to APRIL 1		
Active work.	0.5	
TOTALS	4.5	7.5

(6) It is interesting to note that the work of the Membership Committee, when it is working, is effective. The best estimate is that we obtain 26 personal members a month when the Committee is working and only 14 when it is inactive. The net gain of 12 members per month suggests that we may be losing 90 personal members a year by failing to provide for this type of solicitation work over 12 months instead of only 4 or 5 months. The remedy obviously requires continuous staff work at Columbus, and this involves larger expenditures. The estimate that 90 additional members might be obtained each year is presented as a basis for deciding whether this is practical.

(7) A study of the records for the last three years shows that the number of new members is least during two periods: (1) the reorganization months of May and June when membership applications fall 40% below normal and (2) the months of September and October when a drop of 30% below normal occurs. The latter lag is believed to be due to the hesitancy in paying two years' dues within a period of 3 or 4 months.

(8) The Membership Committee is handicapped by the lack of a prospectus describing The Society's aims, structure, and activities. We are a complex organization, and the whole story cannot be told in a letter.

(9) No recommendations concerning Corporation Membership have been made.

(10) There is a lack of continuous policy in membership work. Each new Membership Committee Chairman needs guidance. He particularly needs to be told that the office staff can assist him only during certain limited periods and that he must plan his work accordingly.

(11) For purposes of record it should be noted that the work of this Committee during the past year has enlisted the cooperation of many Society members, that contact has been maintained with all ceramic schools, that letters of solicitation have been written to prospects on the rolls of the Local Sections, the patent attorneys of the American Bar Association, and the Association of Consulting Chemists. Letters also were addressed to all men who have been graduated in ceramics during the last three years, and two letters were written (one of these is still in the process of preparation) to a mailing list of several thousand

persons derived from various directories and from Meeting registration lists. By far the most effective means of obtaining new members was a drive in which the assistance of several hundred Society members was enlisted.

—R. E. BIRCH, *Chairman*

REPORT OF THE SECRETARY

This Society will not be static. Twenty-four years ago, this Society underwent a revolution and, in the subsequent years, a continued evolution in the Constitution and By-Laws, in the budgeting and accounting of its finances, in committee activities, in meeting schedules, and in publishing its activity results. For twenty years, The Society has made a complete abstract coverage of all published information of ceramic technical value. Collaboration with other technical societies and with ceramic trade associations and the trade press is developing without this Society exceeding its limited role of promoting the ceramic arts, sciences, and technology. Group interests are cared for by the Divisions, the Local Sections, the Fellows, the Institute of Ceramic Engineers, and the Ceramic Educational Council, all within Constitution and By-Law provisions under the supervision of the Board of Trustees.

At its headquarters, there is a growing ceramic library, a large exhibit of ceramic products, and an extensive photograph library of persons active in ceramics. The Society has a considerable stock of its publications and very complete office equipment, all written off and not carried as asset items. It has the modest sum of $21,417.16 in invested reserve.

Notwithstanding withdrawals of members entering the war services and the loss of a considerable number of foreign members, the record of *paid* members as of April 21 for the past three years shows a slight increase.

MEMBERSHIP RECORD

	Paid Personal	Paid Corporation	Deferred	Totals
December, 1939	1876	237	27	2140
December, 1940	1995	260	25	2280
December, 1941	2029	257	37	2323
April, 1939	1641	226	58	1925
April, 1940	1724	241	30	1995
April, 1941	1794	247	47	2088
April, 1942	1836	244	45	2125

The paid foreign subscriptions have dropped from 306 in 1941 to 99 in 1942, and we are now facing an export embargo. The income decrease due to loss of foreign subscriptions will this year total about $2700. Next year, The Society may have to give up all of its foreign members and subscribers.

Report on *Ceramic Abstracts* for 1940–1941

	1940	1941
Number of abstracts published	4492	4374
Number of pages published	371	344
Number of index pages	77	68

The number of journals available for abstracting has decreased from about 600 in 1939 to 350 in 1941. No French, German, Italian, Russian, or Japanese journals are being received, and the English journals are received only with difficulty. No German or French patents are available.

As many former abstracters are now in the armed forces and many others are too busy on defense work to devote much time to abstracting, it requires constant effort to keep journals assigned.

Many journals are being lost in the mail, and the abstracters to whom they are assigned are unable to cover

FOREIGN MEMBERSHIPS

	October 23, 1939		March 30, 1940		March 30, 1941		March 30, 1942	
Country	Personal	Corporation	Personal	Corporation	Personal	Corporation	Personal	Corporation
Australia	10	1	8		6		4	1
Belgium	2		2					
China	7		4		5		1	
Cuba	1							
Czech-Protectorate	2		1		1			
Denmark	3		4		4			
England	83	5	67	5	65	3	53	3
Estonia								
Finland								
France	12	2	4	1	3	1		
Germany	33	1	7		23		1	
Greece								
Holland	9		7		2		1	
Hungary	1		1		1			
India	11	1	3	1	2	1	1	1
Ireland		1		1				
Italy	3		2		1			
Japan	10	3	9	3	10	3		
Latvia	1		1					
New Zealand								
Norway	3		3		1			
Poland	3	1						
Portugal								
Rumania	1							
Scotland	11		11		9		11	
Siam								
South Africa	7	1	1	1	2		3	1
Spain	1							
Sweden	7		7		7		3	
Switzerland	1		1				1	
U.S.S.R.	2		1		2		1	
Wales					1		1	
TOTALS	224	16	144	12	145	8	81	6

them. An attempt is being made to assign such missing numbers to other abstracters to whom they are available so that no important articles will be unreported.

Report on Papers Published April 10, 1942

TOTAL PAPERS* PUBLISHED FROM 1938–1941 AND THROUGH MAY, 1942

	Journal	*Bulletin**	Total
1938	55	48	103
1939	62	66	128
1940	68 (366 pp.)	57 (198 pp.)	125 (564 pp.)
1941	64 (408 pp.)	65 (224 pp.)	129 (632 pp.)
1942	41 (274 pp.)		

* Totals of pages do not include *Bulletin* Activities and Notes.

There are 45 *Journal* papers in the office which have not been scheduled for publication: 24 are in type, 9 are new (not reviewed), and 12 are being held.

LOCAL SECTION NEWS

SOUTHERN CALIFORNIA SECTION

Four regular meetings of the Southern California Section were held during the year. From 65 to 75 persons attended each meeting, and the programs were all interesting and educational.

The annual party, held at the Montebello Country Club, was attended by 93 members. Steak dinners, entertainment, and refreshments were the order of the day.

Officers for 1942–1943

Chairman: J. E. STEVENS, Emsco Refractories Co., 8601 Dorothy Ave., South Gate, Calif.
Vice-Chairman: R. H. MARTIN, Vernon Kilns, 2300 E. 52d St., Los Angeles, Calif.
Secretary-Treasurer: R. F. EVANS, Gladding, McBean & Co., 2901 Los Feliz Blvd., Los Angeles, Calif.

—R. H. MARTIN, *Secretary*

PITTSBURGH SECTION

The regular monthly meeting of the Pittsburgh Section was held in the Faculty Club of the Cathedral of Learning on May 12. This was the annual dinner meeting and was blessed by the presences of the members' "sweethearts."

Ross C. Purdy, General Secretary of The Society, acted as genial toastmaster. After expressing his personal greetings to Canada and Great Britain, he introduced Captain Ledyard Towle, industrial designer for the Pittsburgh Plate Glass Company, Pittsburgh, Pa. Captain Towle discussed the use of glass as a substitute for restricted materials and the new uses developed for our wartime needs. He also outlined the work being done to protect Pittsburgh against air attack with respect to blackouts and camouflage.

The next speaker was President Louis J. Trostel, who voiced his greeting on behalf of The American Ceramic Society. He complimented the Section on its activities and expressed hope for its continuance during the war period.

The toastmaster then introduced Charles E. Robinson, manager, War Production Board, Contract Distribution Branch, Pittsburgh, Pa. Mr. Robinson explained the purpose of his office and its authority. He also mentioned several cases where ceramic materials could possibly replace materials of which there is now a shortage.

The meeting was closed by Ted Lenchner, chairman of the dinner committee.

—R. M. SHREMP, *Secretary*

CERAMIC SCHOOL NOTES

UNIVERSITY OF ALABAMA

The University of Alabama Student Branch of The American Ceramic Society held a short meeting on April 30, 1942. At this time, a U. S. Bureau of Mines film, "The Story of a Spark Plug," was shown. A general discussion followed the showing of the film.

As this meeting was the last of the college year, an election of officers for the coming year was held. E. J. Briganti, a junior in the School of Chemistry, Metallurgy, and Ceramics, was elected president. Because of the uncertainties which now face many of the students, it was deemed advisable not to elect any other officers until the first autumn meeting.

—HERSHEL EMISON, *President*

OHIO STATE UNIVERSITY

Student Branch

The first spring meeting of the Ohio State University Student Branch was held on April 8 in Lord Hall.

The speaker for the evening was H. D. Foster, Columbus, Ohio, who spoke on "Salt Glazing." He explained some of the problems in this field and showed some samples of glazed ware.

Keramos

The activities for 1941–1942 of the Ohio State University Chapter of Keramos started with a dinner meeting held on October 28, 1941; since then there have been three dinner meetings and six business meetings.

Keramos held its annual open house, centered around national defense, on January 20, 1942. Guests were conducted through the various laboratories. Speakers discussed the importance and aims of ceramics and Keramos.

Formal initiation of new members was held at the Fort Hayes Hotel on May 9, 1942. The following men were initiated: Neil Ault, Morris Berg, Kenneth Baab, Albert Caton, Dudley Frame, Richard Fuller, James Johnson, Stanley Lull, Roberto Sada, and Archie Shukle.

Honorary Member for 1941–1942 is H. M. Kraner, Bethlehem Steel Co., Bethlehem, Pa.

Keramos Officers for 1942–1943

The following officers were elected at the meeting held on May 12: *President,* Robert Thomas; *Vice-President,* Richard Fuller; *Secretary,* James Johnson; *Treasurer,* Neil Ault; and *Herald,* Kenneth Baab.

UNIVERSITY OF NORTH CAROLINA

Keramos

Three outstanding students in the Department of Ceramic Engineering, E. D. Cox, Charlotte, N. C., R. E. Brickhouse, Jr., Warrenton, N. C., and R. B. Adair, Beaufort, N. C., were initiated into Keramos at an impressive initiation ceremony. Following the initiation, the annual farewell banquet was held honoring the seniors and new members.

The scholarship awards made annually to a freshman and an upperclassman were won by W. B. Midgette, Raleigh, N. C., who was awarded the Moland-Drysdale Scholarship Cup, and Edwin D. Cox, Charlotte, N. C., who was awarded the J. C. Steele Scholarship Cup.

Officers for 1942–1943

R. JACK SMITH, JR., Goldsboro, N. C., *President,* who replaces Howard L. Miller, Mooresville, N. C.; JAMES E. PARTLOW, Olive Hill, Ky., *Vice-President;* J. E. SHOFFNER, Raleigh, N. C., *Secretary;* C. V. RUE, Raleigh, N. C., *Treasurer;* and GEORGE D. MARTIN, Charlotte, N. C., *Herald.*

UNIVERSITY OF ILLINOIS

C. W. Parmelee Honored

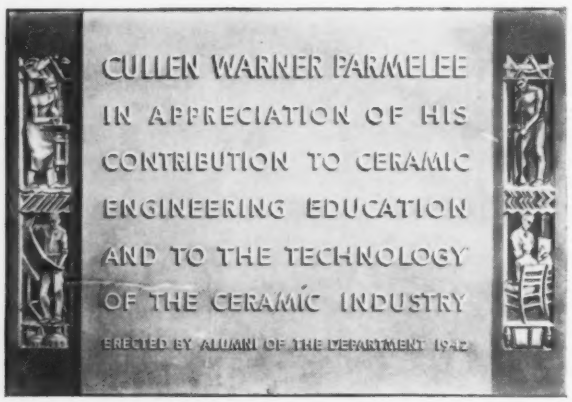
The Illini Dinner held at the Canary Cottage in Cincinnati, Ohio, at the time of the Annual Meeting of The American Ceramic Society was of special significance this year. It honored C. W. Parmelee on the occasion of his retirement at the end of this year as the Head of the Department of Ceramic Engineering, which he has so wholeheartedly served for over a quarter of a century. Nearly one hundred Illini alumni from all branches of the ceramic industry attended the dinner. D. G. Bennett, Class of '30, Mellon Institute, Pittsburgh, Pa., acted as chairman, and T. N. McVay, Class of '14, Head of the Ceramic Department at the University of Alabama, University, Ala., gave the following address:

"These Illinois dinners have meant much to all of us as we have the opportunity to meet with one another in the traditional spirit of Illinois good fellowship.

"This meeting tonight is of particular significance, for it is in honor of you, Professor Parmelee, a friend and a councillor to each of us.

"We wish to honor you for the fine work that you have done at Illinois and for the enormous amount of important work which you have accomplished in your twenty-five years of service at that institution and for carrying on the excellent work of men like Rolfe, Purdy, Bleininger, Stull, and Washburn who preceded you.

"We are proud of the fact that we were graduated from the best ceramic school in the world, and we are confident that, under the leadership of A. I. Andrews, it will go steadily forward.



Design for commemorative plaque to be placed in the main hall of the Ceramic Building at the University of Illinois, Urbana, Ill.

"Even though you are retiring as Head of the Department, we know that your untiring energy will keep you moving continuously onward and that freed of the tedium of administrative duties of office, your accomplishments in the future will at least equal if not surpass the work which you have done in the past.

"As a scientist, an administrator, a friend, and a gentleman, we salute you.

"I would like to recognize the members of the Committee who have served so cheerfully and well in making this occasion possible. In spite of Pearl Harbor and the anxieties of the times, the alumni came through as the alumni of Illinois always do. Members of the Committee are as follows: R. K. Hursh, *Adviser;* H. D. Frankel; H. G. Wolfram, *Cochairman;* C. L. Thompson; F. S. Markert; F. L. Steinhoff; F. A. Petersen; W. V. Boeker; D. G. Bennett, *Secretary;* and T. N. McVay, *Chairman.*

"On behalf of myself, thanks to each and every one of you for your cooperation and good counsel. I am particularly grateful to the alumni for their whole-hearted support in this undertaking.

"The spoken word, however true and sincere, soon becomes only a memory and may be forgotten. We, as alumni, wish to show our appreciation and honor you in a way that should be as imperishable as old Mother Earth herself. No better medium can be found than in ceramics; consequently a plaque has been designed in terra cotta. Professor Hursh, who is chairman of this Committee, will present the design of the plaque."

R. K. Hursh presented the design for a commemorative plaque (see accompanying photo) which is to be executed in terra cotta and placed in the main hall of the Ceramic Building. C. L. Thompson, Class of '26, the Harbison-Walker Refractories Co., Pittsburgh, Pa., presented on behalf of former graduates of the Department of Ceramic Engineering a Book of Letters, handsomely bound in blue leather, which contains personal letters of commemoration. On the outside of the book is inscribed in gold letters, "To 'C. W.' from the Boys."

There was also established a Student Loan Fund, to be known as the Cullen Warner Parmelee Student Loan Fund, for the benefit of needy students in the Department of Ceramic Engineering at the University of Illinois. The operation of the Loan Fund was outlined by A. I. Andrews, who succeeds Dr. Parmelee as Head of the Department of Ceramic Engineering.

At the meeting of the General Session of The American Ceramic Society, Professor Parmelee was also awarded a Life Membership in The American Ceramic Society, an honor which has been conferred only on charter members heretofore.

Alumni and Student Branch News

Lt. Joseph F. Smith, Class of '41, has been awarded the Distinguished Service Cross for valor in action on the Bataan peninsula.

Rexford Newcomb, Jr., Class of '36, now serving on the War Production Board and formerly connected with Industrial Publications, Inc., spoke on the relation of ceramics to the war at the Student Branch meeting held May 8.

At the present time, there are sixty-one graduates of the Department of Ceramic Engineering serving with the armed forces all over the world. All ranks are represented up to and including that of Major.

The following officers for 1942–1943 were elected by members of the Student Branch at a recent meeting: *President,* F. P. Shonkwiler; *Vice-President,* E. R. Smith; *Secretary,* Joe Dora; and *Treasurer,* John Graham.

The Pig Roast, the annual banquet sponsored by the Student Branch, was held April 30. The group of sixty-two who attended enjoyed the "sense and nonsense." Dr. Audrieth of the Chemistry Department gave an illustrated lecture on home defense against aerial attack.

NECROLOGY

WILLIAM J. GARDNER*

William James Gardner, chairman of the Meltham Silica Fire Brick Co., Ltd., Meltham, near Huddersfield, England, and one of the "Old Guard," died on February 10, 1942, following a brief illness. He was seventy-seven years old.

In the December, 1939, issue of *The Refractories Journal,* a comprehensive review of his career was published when reporting the Complimentary Banquet which was given on the occasion of his retirement from the managing directorship of the Meltham Silica Fire Brick Co., Ltd.

Since he began his career in the refractories industry in 1887, Mr. Gardner rendered outstanding service to the

* From *The Refractories Journal,* **18** [3] 65–66 (1942).

refractories industry, and his death is a reminder that it has been "no heritage" but an untiring personal effort to advance the interests of the industry and his Company both fraternally and scientifically, for Mr. Gardner was a man with an aptitude for delicate mathematical work and a fondness for scientific investigation.

His Career

Born at Macclesfield in 1864, Mr. Gardner was the elder son of the Reverend James Bullock Gardner, who occupied important pulpits in the Unitarian Church at Birmingham and at Sheffield.

Trained as a civil engineer, serving his articles under Robert Davison, the Borough Engineer of the City of Sheffield, Mr. Gardner, at the conclusion of his training, became District Surveyor for the Central and Eastern Divisions of Sheffield and was responsible for the carrying out of important schemes of city improvements and park extensions.

It is not surprising that a man with the energy and forethought of Mr. Gardner was not content to remain in municipal service, so, in 1887, he became engineer to Messrs. J. Grayson Lowood & Co., Ltd., manufacturers of silica and fire-clay brick. To further equip himself for a post of great responsibility in a rapidly developing industry, Mr. Gardner studied chemistry under A. H. Allen, the Borough Analyst of Sheffield.

William J. Gardner

Pioneer Work

The scientific study of refractories was then in its infancy, and in establishing a laboratory at the Deepcar Works and initiating important research work, Mr. Gardner became a pioneer in the application of scientific methods to the production of refractories.

Launched Meltham Company

In 1900, Mr. Gardner went to Meltham, near Huddersfield, where, with his colleague and friend, the late Frank Charlesworth, he founded the Meltham Silica Fire Brick Co., Ltd., silica brick manufacturers, whose specialized products are used extensively today for furnace linings in the gas, coke-oven, and glass industries.

It was here that his training in engineering and chemistry stood him in good stead in developing the new works. The Meltham highly converted silica brick became a standard of quality.

Organization Memberships

Mr. Gardner was a founder of Keramos Lodge No. 4967. A Freemason of many years standing, he held Provincial Rank and was a member of the Lodge of Peace No. 149, of which he was the oldest Past Master, and Lodge of Truth No. 290.

In 1921 and 1922, he served as president of the Refractories Association of Great Britain and was a past-president of the British Ceramic Society and vice-president of the National Association of Clayworks Managers. He was also a member of the Council of the British Refractories Research Association, the Society of Glass Technology, the Refractory Materials Joint Committee of the Gas Research Board, and of numerous other trade and technical organizations.

Retirement

An Illuminated Address and Solid Silver Casket suitably inscribed were presented to Mr. Gardner at the Complimentary Banquet held on his retirement at the George Hotel, Huddersfield, on December 1, 1939, when his colleague, Job Holland, was in the Chair.

"..... You have at all times maintained a standard of high probity in your human relationships," read the Address, "and in your commercial dealings your name has always been synonymous with uprightness and integrity ..... Your name will for all time be specially and particularly associated with those improvements in the operation of coke ovens and gasworks which have been rendered possible by your pioneer work in the production and perfecting of the Meltham silica brick for use in coke-oven construction and gas retorts, and for this the industrial world owes you a deep debt of gratitude.

"We sincerely appreciate your general services to the refractories industry..... and we, with many others too numerous to mention, will long continue to be grateful to you for your gracious and adequate leadership of the British Ceramic Society during the Wedgwood bicentenary celebrations."

Local Activities

In addition to his many business activities, Mr. Gardner also assisted in the general welfare of the community. He was a founder and past-president of the Meltham Golf Club and Meltham Bowling Club and was instrumental in forming the old Meltham Operatic Society, in which he took an active interest.

A Postscript

A man of erudition and charm, William James Gardner lived a full life. He was always of a most genial and active disposition, and his cheery presence will be greatly missed by a large circle of friends.

A critic and an analyst by nature, he was forceful, independent, masterful, courageous, and positive. He would not tolerate imposition nor would he be swerved from his purpose by opposition, but for kindness he would sacrifice a great deal. There were times when he was abrupt and even satirical and given much to controversy, but he was, nevertheless, endowed with a very sympathetic nature, although he tended to be somewhat reserved in expressing it.

With his passing, *The Refractories Journal* has lost a good friend, for he was one who s rongly supported the idea of establishing the *Journal* and gave encouragement when it was most needed.

(1942)

GEORGE BRAIN

George Brain, pioneer in the development of the casting process for vitrified ware, died at his home in Tiffin, Ohio, on April 7, 1942.

George Brain was born in Hanley, Staffordshire, England, October 1, 1881, of a family which for several generations had all been potters. As a child of six, he would take his father's noon-day meal to the plant, which meant a handful of clay with which he would fashion things. Even as a small boy he was full of questions as to why things were done as they were.

He was graduated from public school when he was fifteen years old and went to work as a modeler's apprentice for the firm of Howson's, the plant with which his father was associated. He quickly developed an unusual aptitude for modeling, and in time advanced to be head of the modeling department.

After his day's work at the plant was finished, which, in those days, was not before six o'clock, he studied at the School of Arts and Crafts, where he modeled a plaque which won for him a medal and a scholarship to South Kensington in London. Unfortunately, his family's means did not permit his following an art career, but the skill acquired in those days later stood him in good stead when he designed better-functioning sanitary ware with more pleasing lines.

George Brain

During Mr. Brain's younger days at Howson's, the casting process began to be developed in the English sanitary ware plants. He studied assiduously in the evenings at the School of Ceramics at Stoke-on-Trent, which was just getting into its stride under the direction of J. W. Mellor. Here he gained a theoretical knowledge which he was able to translate into the practical operations of casting ware at Howson's, who were manufacturers of fire-clay porcelain goods, i.e., a fire-clay base covered with engobe and glaze. By 1915, he was superintendent of the casting shop.

The first sanitary ware plant in the United States to take up the casting process for making sanitary ware was the Universal Sanitary Manufacturing Company of New Castle, Pa., which was headed by Charles J. Kirk, who also pioneered the tunnel kiln and other important developments in this industry. In the summer of 1915, while the first Dressler tunnel kiln was in the process of erection at the Universal plant, Mr. Kirk and his partner, Walter S. Kupfer, commissioned Conrad Dressler, the inventor and patentee of the kiln, to seek out on his return to England a competent English potter who could bring to the United States the casting technique developed in England. After interviewing many candidates, Mr. Dressler recommended George Brain for this position; he was accordingly invited to come to the United States, where he became superintendent of the Universal Sanitary Pottery in the fall of 1915.

Mr. Brain stayed at this plant for seven years, during which time he perfected the technique of casting the vitreous bodies used in American ware and worked out the various problems in the adaptation of tunnel-kiln firing to this ware.

In 1922, he was invited by the Standard Sanitary Manufacturing Company of Pittsburgh, Pa., to go to their Tiffin, Ohio, plant and there introduce the casting process. When he arrived in Tiffin, he found the plant completely shut down owing to a strike of the sanitary potters, and he had to start from scratch with green help, such as farmers and mechanics who had no previous experience in the potting industry. He was so successful in this operation that in less than six months the plant was turning out a larger amount of ware than at any previous time.

His advancement in the Standard organization was rapid. He was soon superintendent of the Tiffin works, then general superintendent of potteries. The plant at Kokomo, Ind., adopted the casting process at the same time as the Tiffin plant. A new plant was later built at Richmond, Calif., where the techniques developed by George Brain at Tiffin were put into operation.

In 1928, the Standard Sanitary Manufacturing Company built a pottery at Neuss, Germany, where the manufacture of vitrified sanitary ware was introduced into Europe. George Brain made many trips during and after the erection of this plant and was successful in introducing to the Old World the advances made in the New.

After the consolidation of the Standard Sanitary Manufacturing Company with the American Radiator Company in 1929, numerous potteries for the manufacture of vitrified sanitary ware were built in other countries. In 1934, a pottery was built at Toronto, Canada; in the 1930's, other plants were built in France, England, Italy, and Spain. George Brain spent more and more of his time at these plants, and finally, in 1936, accepted an invitation of his firm to make his headquarters in Europe as general superintendent of the European potteries. He stayed in Europe for three years, returning to the United States in the summer of 1939 just before the outbreak of the War.

In addition to his success in working out the technical problems of casting vitrified ware, George Brain made many contributions to the actual design of the ware. A large proportion of the Standard Sanitary line was designed and modeled by him, e.g., the Brainard line, the Moderno closet, and the one-piece closet and tank combination.

It gave him great satisfaction to take back to the country of his birth and education the methods of making vitrified ware which, until the establishment of the Standard Sanitary plants in Europe under his direction, were not known there. He thus completed in his active lifetime the cycle of the beginnings of casting in England on semivitreous and fire-clay bodies, the development of the vitreous ware in the United States, and the return of this improvement to England.

In addition to his work in the vitrified sanitary industry, George Brain also made a large contribution by his advocacy of the casting of saggers, slabs, and other refractory parts needed for supports in firing sanitary and other ware. He started this work at the Universal Sanitary Manufacturing Company at New Castle. He later acted as

consultant to the New Castle Refractories Company and started them on their successful development of all kinds of cast refractory parts. Such parts were also made at Tiffin under the direction of Mr. Brain.

Mr. Brain is survived by a brother, Isaiah, who has been associated for many years with the Standard Sanitary plant at Richmond, Calif.; two sisters living in England; his daughter, Mrs. Philip Dressler; and his widow and two daughters by his second marriage, Kathleen and Margaret.

Mr. Brain had been a member of The American Ceramic Society since 1917.

DESIGN AND PRODUCTION OF DINNERWARE FOR NURSERY SCHOOLS*

By Paul G. Herold and Stuart Dods

Abstract

A description of raw materials and methods used in the production of earthenware for WPA nursery schools is given. Factors affecting design and decoration of such ware are discussed as well as the solution to the problem as it has been worked out by the cooperating Missouri projects.

I. Introduction

A pottery project, sponsored by the FERA, was established a few years ago at the Missouri School of Mines and Metallurgy to produce dinnerware for various governmental nursery schools in the State. The project provided for a practical potter who formed the ware on a wheel, creating designs as he worked. The ware, however, was unsatisfactory because it was too heavy, and the staff personnel in the nursery schools objected because it did not have a voice in the actual design. This project was abandoned, but it laid excellent groundwork for subsequent efforts by developing a good fritted glaze and starting work on a practical body composition.

Fig. 1.—(*a*) Small pitcher designs; (*b*) large pitcher designs.

Early in 1940, the WPA approved a similar project. Based on the information previously developed, all of the details of manufacture were planned so that they could be used by interested industrial organizations when such information was needed. The present project, established to test Missouri clays for pottery use and to develop ware especially adapted for use in nurseries, is sponsored by the Missouri Geological Survey and the Ceramic Engineering Department of the Missouri School of Mines and Metallurgy.

II. Ware Composition

To have sufficient information to start the project, some time had to be spent in experimentation on a body composition suitable for casting. A body was made of a washed and filter-pressed native stoneware clay known as Zadoc, which is mined near Idalia in Stoddard County, Missouri. The clay is very plastic, which made casting slow and impractical. To speed the time of casting, a large proportion of the raw clay was fired to 700°C. and crushed through 60-mesh. Because Zadoc clay imparts a light buff color to the fired ware, a small amount of whiting and flint was introduced into the body to produce a slightly lighter color. This body worked well in production, but the calcination of the raw clay was too expensive and held up production.

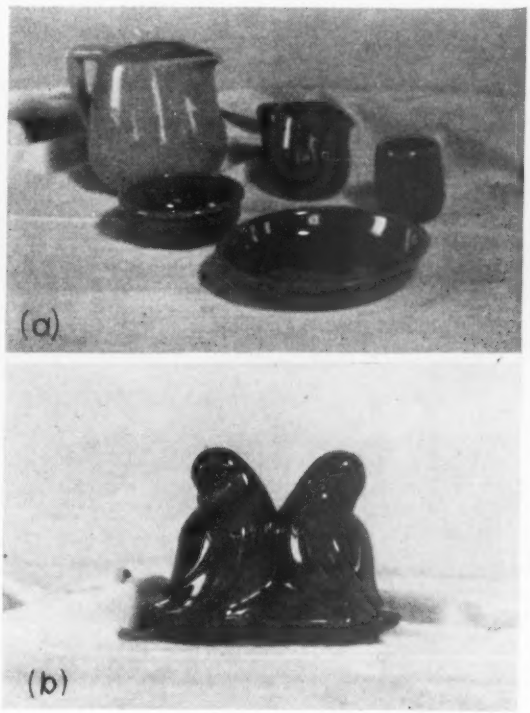


Fig. 2.—(*a*) Complete set of ware (except for the dessert bowl); (*b*) dove centerpiece for table.

* Presented at the Forty-Third Annual Meeting, The American Ceramic Society, Baltimore, Md., April 2, 1941 (Art Division). Received April 3, 1941.

After extensive development tests, the body being used at the present time was adopted. It is made up of flint clay 64, red granite 19, and Zadoc clay 17%. To this is added soda ash 0.2, "N" brand sodium silicate 0.15, and water 52%. The flint clay, mined in central Missouri, is the true flint clay associated with diaspore. The red granite, which is found near Fredericktown, has been used for years for paving block and tombstones.

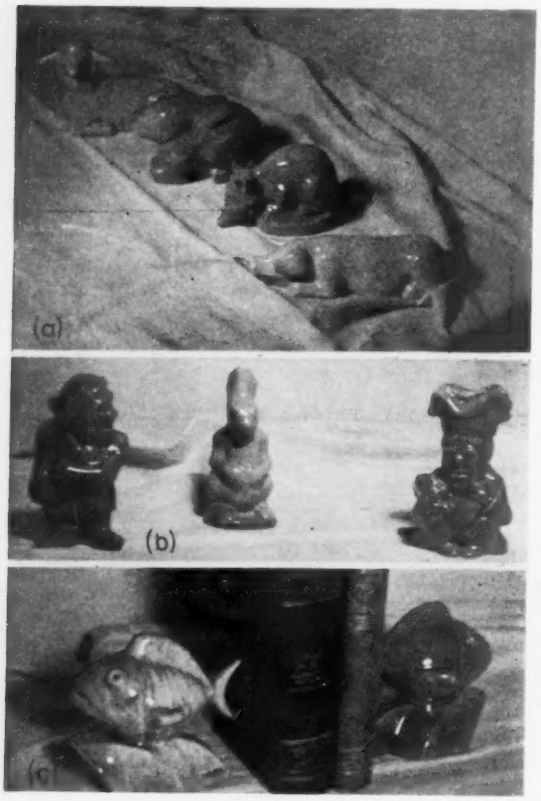


FIG. 3.—(*a*) Centerpiece designs; (*b*) "Alice in Wonderland" centerpiece; (*c*) fish centerpieces used as bookends.

The flint clay is prepared by grinding in a jaw crusher and rolls through 8-mesh and the red granite is crushed through 100-mesh. After the preliminary crushing, the materials are weighed and dumped into a 50-lb. ball mill, which is rotated for 3 hours. At the end of this time, the flint clay is sufficiently fine to produce a smooth, uniform slip. This slip casts usually in about 8 minutes.

The ware is bisque at cone 4, which produces a body with 13% absorption; the hardness is a little greater than that of steel.

The glaze, developed at the same time as the body to give a good fit, is as follows:

Glaze				Frit			
0.1 KNaO 0.7 PbO 0.2 CaO	0.3	2.2 SiO_2 0.2 B_2O_3	Al_2O_3	0.1 KNaO 0.2 CaO 0.4 PbO	0.1	1.0 SiO_2 0.2 B_2O_3	Al_2O_3

The colors are obtained by direct addition of the oxide to the base glaze, and the glazes are applied by spraying. The glost fire, at cone 02 with one hour of soaking, produces a glaze with a hardness a little less than that of quartz.

III. Design

The nursery-school supervisors gave several broad rules to the artists to guide them in the design of the ware, namely, (1) the pitcher and mug must hold about one pint; (2) all ware must be so designed that the handling of the utensils is simplified; and (3) a set must consist of one large pitcher and six each of mugs, plates, individual pitchers, cereal bowls, and dessert dishes. The important point was the fact that the ware was to be used by children in the age group of from 4 to 7 years.

The problems encountered in the design of nursery-school ware are illustrated by the small pitchers shown in Fig. 1 (*a*). The pitcher second from the left was the first one designed; the spout, however, was not pulled out so far. This pitcher had good balance (i.e., would not tip over easily) and was simple in form, thus allowing ease in forming by inexperienced workers. Liquid poured from this pitcher, however, tended to run down the outside. This defect was corrected by flaring out the lip to a point. The next pitcher designed (extreme right) had a solid handle. The spout was changed by putting a rolled or beaded edge along the top to eliminate poor pouring. The pitcher on the extreme left is exactly the same except for an open handle. Some of the supervisors thought that the closed handle might be easier to hold; actual use, however, has proved that the open handle is best. The second pitcher from the right has a high handle, which was introduced to change the physical balance.

Some of the large pitchers designed are shown in Fig. 1 (*b*). The center pitcher was too high, inasmuch as a supervisor eats with a group of five children and serves milk from the large pitcher to the individual small pitchers. The large pitcher must be rather short so that the supervisor can see all that goes on at the table. The two pitchers on the ends were designed to overcome this objection.

Figure 2 (*a*) shows a complete set of ware (except for the dessert bowl). The plate and bowls are designed with deep sides to facilitate getting the food onto a spoon.

The nursery-school supervisors also requested that some figurines be designed which could be placed at the center of the dinner table to attract the attention of the children. This is done to familiarize the children with farm animals and also to divert their attention from the food. The first centerpiece designed (Fig. 2 (*b*)) was too conventional to be satisfactory. A later set of designs, shown in Fig. 3 (*a*), was more successful. Figures 3 (*b*) and 3(*c*) show other centerpieces which are being widely used in the State.

IV. Summary

The pottery project has attained some new designs which are not entirely satisfactory. Much work remains to be done, especially in regard to the reaction of the children to the various pieces of ware, which is the deciding factor in the production. The work does not intend to compete with private industrial enterprise in any way, but rather to produce some results which may be of benefit to industry.

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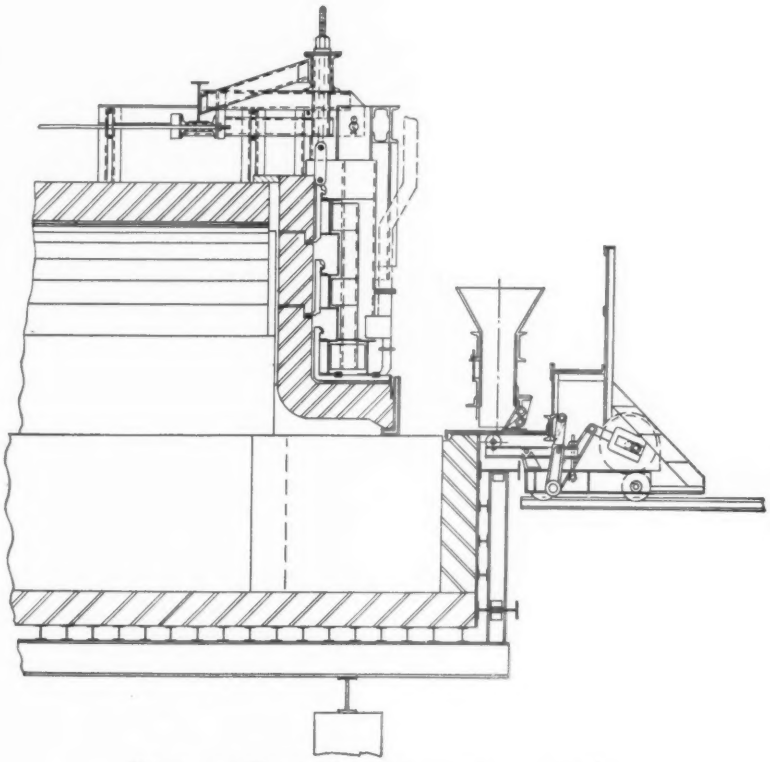

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Harshaw Chemical Co.
The Hommel, O., Co., Inc.
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Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Micronized)
Porcelain Enamel and Mfg. Co.

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Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Potters)
Denver Fire Clay Co.
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Process Equipment)
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National Engineering Co.

Clay (Sagger)
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Maxson, Elwyn L.
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Potters Supply Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay-Slip (Albany)
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United Clay Mines Corp.

Clay (Wad)
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Spinks, H. C., Clay Co.
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United Clay Mines Corp.

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Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

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Porcelain Enamel and Mfg. Co.

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Pennsylvania Salt Mfg. Co.

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Harshaw Chemical Co.
The Hommel, O., Co., Inc.

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Harshaw Chemical Co.
The Hommel, O., Co., Inc.

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Harshaw Chemical Co.
The Hommel, O., Co., Inc.
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Norton Co.

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Harshaw Chemical Co.
The Hommel, O., Co., Inc.
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Norton Co.

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Electro Refractories & Alloys Corp.
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Norton Co.
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The Hommel, O., Co., Inc.
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The Hommel, O., Co., Inc.

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Carborundum Co.
Electro Refractories & Alloys Corp.
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Denver Fire Clay Co
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American Potash & Chemical Corp.
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Sodium Antimonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Sodium Fluoride
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.

Sodium Nitrite
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Sodium Silica Fluoride
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co
The Hommel, O., Co., Inc.

Sodium Uranate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co
The Vitro Mfg. Co.

Spray Booths
The Hommel, O., Co., Inc.

Spraying Equipmentemt
The Hommel, O., Co., Inc.

Spurs
Louthan Mfg. Co.
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Lancaster Iron Works, Inc.

Stilts
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Louthan Mfg. Co.
Potters Supply Co.

Sulfur
Stauffer Chemical Co.

Sulfuric Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Talc
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
International Pulp Company
Paper Makers Importing Co.

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Corhart Refractories Co.

Tanks (Pickle)
The Hommel, O., Co., Inc.

Tanks for Raw Material Steel or Concrete
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile Setter Pins
Louthan Mfg. Co.

Tile (Refractory)
Carborundum Co. (*Carbofrax*)
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
Thomas Alabama Kaolin Co.

Tile (Wall)
Denver Fire Clay Co.
Thomas Alabama Kaolin Co.

Tin Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Drakenfeld, B. F., & Co.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co. Inc., R. & H. Chemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Trisodium Phosphate
Harshaw Chemical Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
Louthan Mfg. Co.
McDanel Refractory Porcelain Co
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

Uranium Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Uranium Oxide (Yellow-Orange-Black)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Wet Enamel
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Whiting
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

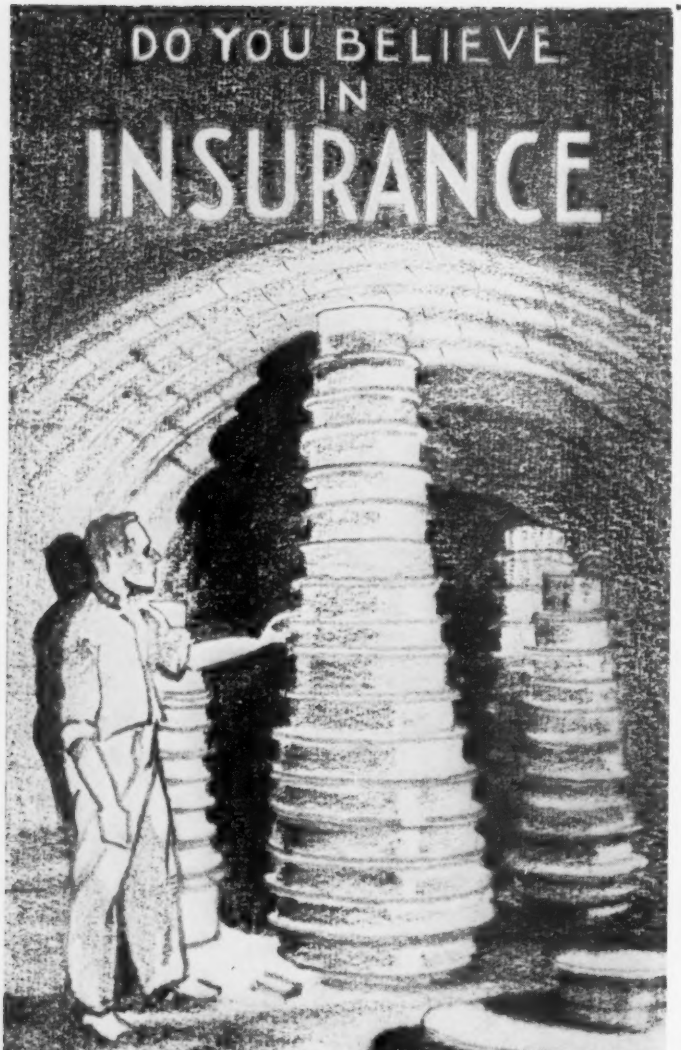
Zinc Oxide
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Zircon
Foote Mineral Co.
The Hommel, O., Co., Inc.

Zirconia
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Zirconium Oxide
Foote Mineral Co.
The Hommel, O., Co., Inc.
Titanium Alloy Mfg. Co.

Zirkite (Natural ZrO_2)
Foote Mineral Co



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THE R. & H. CHEMICALS DEPARTMENT

With the same products . . . the same policies . . . the same personnel you have known in the past.

AS OF JUNE 1, 1942, The R. & H. Chemicals Department of Du Pont will be designated as the Du Pont Electrochemicals Department. This involves no change in the products you use, the policies you know or the people who serve you. The same experienced group of chemists, engineers and others will continue to further your interests through research, development, control, service and production. The development of new and better chemicals will remain a primary objective.

The products of the Electrochemicals Department will be, as before, a line of specialized chemicals derived principally from salt. In addition, it will continue to manufacture other specialties such as formaldehyde and its derivatives, polyvinyl alcohol, polyvinyl acetate, and ceramic colors and decorations.

The products of the Du Pont Electrochemicals Department are important in practically all branches of industry:

Chlorinated Solvents—for dry-cleaning, metal degreasing, extraction of oils and many other uses.

Peroxides—for bleaching, pharmaceutical and cosmetic preparations, general oxidation purposes.

Cyanides—for steel treating, electroplating, metal cleaning, fumigation, organic synthesis.

Refrigerants—for domestic and commercial refrigeration units.

Sodium, 99.9%—reactive chemical for industrial and laboratory work.

Formaldehyde and its Derivatives—for plastic manufacture; disinfecting; embalming fluid, treating paper, leather, textiles; chemical synthesis.

Electroplating Chemicals and Processes—for decorative and protective coatings on metal parts.

Ceramic Materials—for manufacture and decoration of glass, china, tile, terra cotta, porcelain.

Miscellaneous Chemicals—for Plating, Refrigeration, Plastics, Ceramics, Extermination, Rubber, Textile, Leather, Paper, Pharmaceutical and Process Industries.

Our Technical Service will continue to cooperate with you in every way possible. You may find it even more helpful in today's emergency. Technically-trained men are at your service with the practical experience necessary to answer your questions on the use of specialties and specialized electrochemicals. They are ready to work with you in your plant or in our research laboratories.

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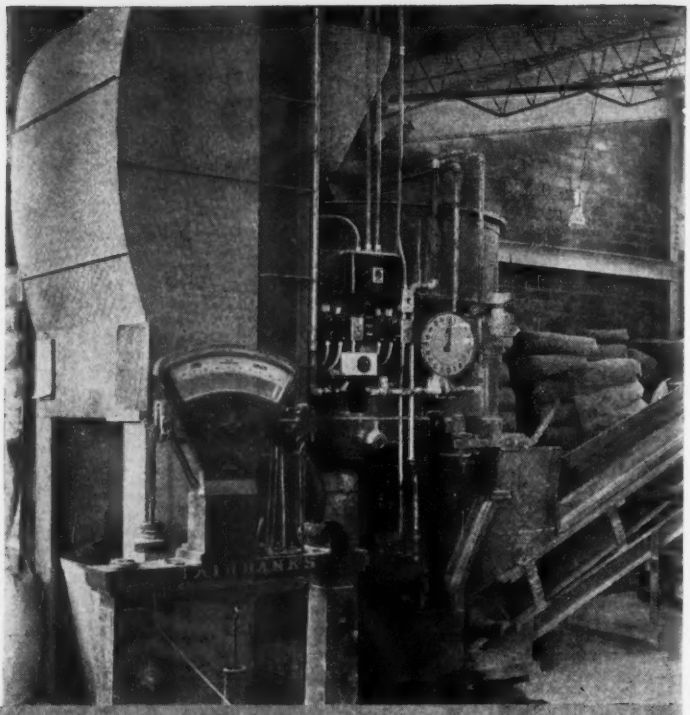
Established 1802

E. I. du Pont de Nemours & Company, (Inc.)

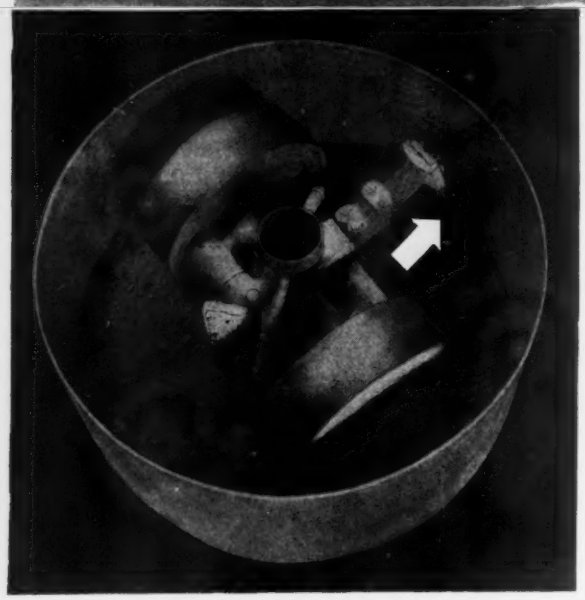
Wilmington, Delaware

How to Prevent the Agglomeration or Balling of Materials in

GLASS or FRIT BATCH MIXING...



Use SIMPSON *Intensive Mixers*



• *Directly above is a view showing a No. 2 SIMPSON Mixer mulling material. Note shoveling and directional action of plows. At the top, right, is a typical installation view of a complete SIMPSON Mixer System used for preparing ceramic materials.*

QUICK FACTS: In an effort to clarify certain phases of an apparent misunderstanding of what can and what cannot be done by modern machinery for mixing glass or frit batches, we present the following "questions and answers".

QUESTION: *Is it possible to prevent the agglomeration or balling of certain materials, such as zinc oxide, in mixing glass or frit batches?*

ANSWER: *YES*—By using SIMPSON Intensive Mixers for positive, controlled mixing, through mulling, of all materials, *including zinc oxides.*

QUESTION: *How does the SIMPSON Mixer accomplish the difficult job of completely blending these extremely fine, clinging materials, which tend to "ball"?*

ANSWER: To handle materials for glass and frit batches efficiently, the two heavy mullers in SIMPSON Mixers are adjusted so that they just clear the wearplate, to smear out any "balls", and completely incorporate them into the batch.

• These answers are not "guesses" — they are *facts!* SIMPSON Mixers in use throughout the country prove beyond doubt that agglomeration or balling of materials can be and is being reduced and eliminated through the installation of these modern units. Write for details.

SIMPSON

INTENSIVE MIXERS

NATIONAL ENGINEERING COMPANY

MACHINERY HALL BUILDING • CHICAGO, ILLINOIS

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THE CARBORUNDUM COMPANY

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JOURNAL OF THE SOCIETY OF GLASS TECHNOLOGY

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NEWPORT, KY.

June 1, 1942

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Comfortable Sanitary Pottery Mfg. Co.
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If the war program has curtailed your volume of production, your margin of profit is of course smaller; and if you are making ware for the Government, you want to give them the best possible quality and service and the lowest possible price. Why shouldn't you? This is the best country on earth—it's yours—and you want to help fight the dogs that have attacked us!

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General Manager
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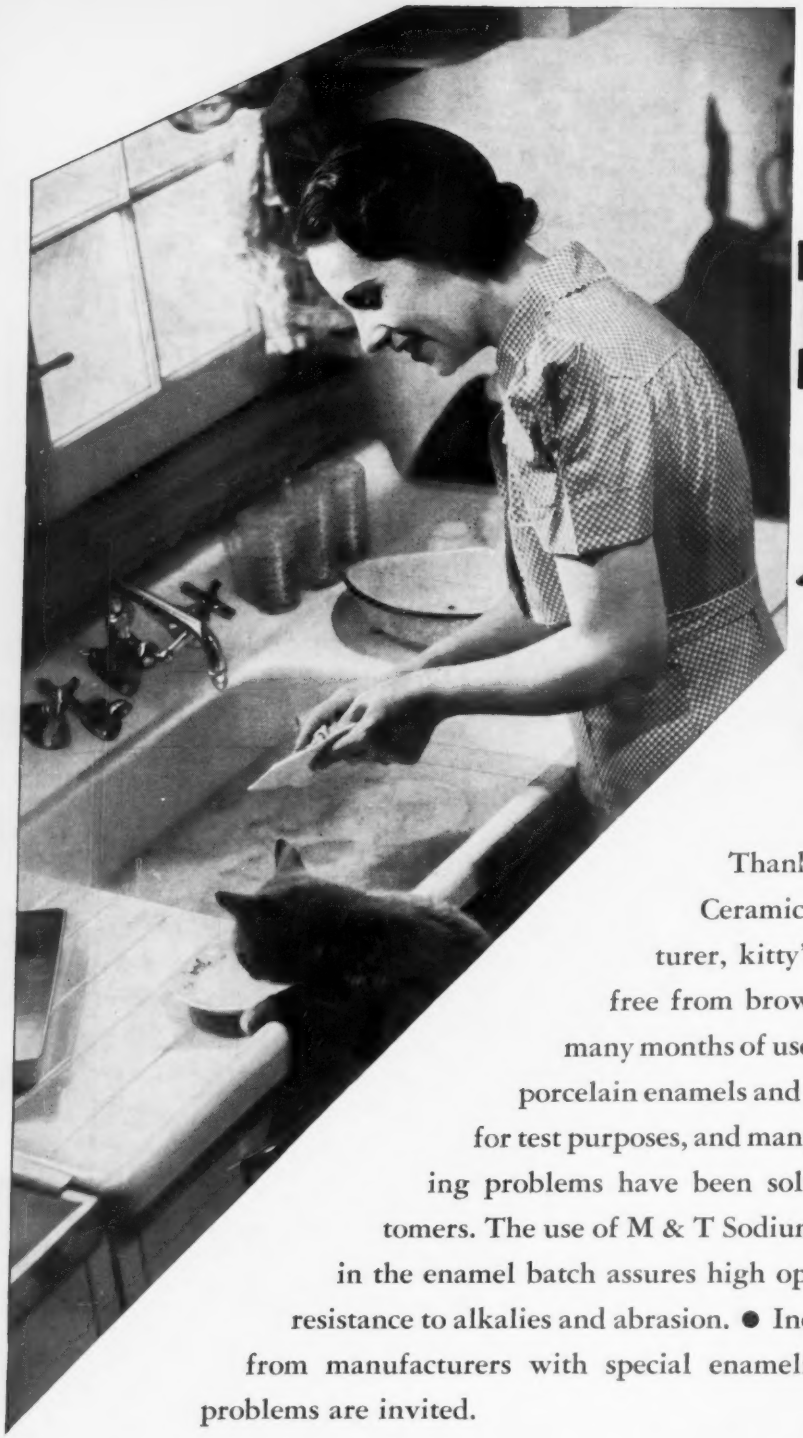

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For glazes and vitreous enamels use M & T Tin Oxide. Careful laboratory control assures uniformity and freedom from specks and discolorations.

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SODIUM ANTIMONATE

METAL & THERMIT CORPORATION

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